Community matters: Local knowledge and social connections for disaster preparedness in Washington State

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Abstract

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People have capacities, skills, and knowledge that they often utilize to recover from a disaster but which are overlooked by planners and policymakers (Aldrich, 2017; Dynes, 2002; LaLone, 2012; Tierney, 2014). Voices of ordinary people, especially those who are marginalized, need to be heard and incorporated in disaster risk reduction activities. Disaster researchers, planners, and ordinary people can learn from each other and co-create new knowledge to collectively devise effective solutions to persistent problems. In this dissertation, I examine disaster preparedness and mitigation through individual and community lenses using social vulnerability, asset-based community development, and social capital theories. Social vulnerability research primarily focuses on systems of oppression that create vulnerable places and people but rarely accounts for community-based assets that could be used for disaster readiness.

In Chapter 2, which is a case study of Plain, Washington, I found that a community readiness approach that is asset-based, internally focused, and relationship-driven may help mobilize local people, organizations, and institutions to actively engage with one another, and devise solutions on the multiple ways to survive and adapt to wildfires and subsequent flooding in the wildland urban interface. This approach can help urban planning and emergency management practitioners engage local assets to solve localized resilience problems for the long-term. Combined with scenario planning methods, this process produced four future scenarios using fire, flooding, and population as drivers of change in Plain. In a planning workshop, participants used stories about the community's identity, values, and assets to develop (1) robust mitigation strategies that would be appropriate for a wide range of future change scenarios, thus helping to set investment and policy priorities even given uncertainty about the future; as well as (2) a suite of different contingent mitigation strategies that are each appropriate for a specific modeled future change scenario.

Chapters 3 and 4 use an asset-based community readiness approach and employ survey research methods and a survey experiment to assess individual and community-level factors related to disaster preparedness and resilience to earthquakes. These studies rely on data from a mail survey sent to a random sample of Seattle households (N=1,342) stratified by zip codes selected for their contrasting demographic characteristics called South Seattle (ethnically diverse, low-income, less formally educated) and Other Seattle (predominantly white, middle- to high-income, more formally educated). Chapter 3 assesses how day-to-day resources, specifically food, water, and social capital, could influence disaster preparedness across different communities. Measurements of social capital (bonding and bridging) were associated

with increased preparedness. This suggests that those with greater social capital are likely to be more prepared before and during disasters. Other Seattle reported more bridging social capital than South Seattle, meaning they are likely to have more connections with individuals who are not like them in respect to socioeconomic or other characteristics, who are available to support them in response and recovery. Accounting for shared resources was induced in half of the surveys (randomly assigned to half of each sample by zip code) by framing the preparedness questions with "Consider how you and your family, friends and neighbors might share." Accounting for shared resources increased reported preparedness levels beyond asking for reports of resources available to individual households.

Available resources vary in quantity and quality across different communities in large part due to historical processes that advantage, and disadvantage, different groups based on race, sex, gender, and other characteristics. A ramification of systematic inequality may be warranted lack of trust and low perceptions of fairness in historically disadvantaged communities. Feelings of fairness and general reciprocity (trust) can impact who people expect to rely on post-disaster assistance. Chapter 4 measures perceived fairness and trust across community types, and examines how perceived fairness, general reciprocity, and preparedness influence expected reliance on local informal (household members and people in the neighborhood) and formal professional (fire, police, and emergency personnel) response groups. Respondents in South Seattle reported less perceived fairness and less trust than respondents in Other Seattle. General reciprocity was positively associated with reliance on both informal and formal response and recovery support groups, after controlling for other influences. Also, increased preparedness was associated with more reliance on household

members and people in the neighborhood, and less expected reliance on fire, police, and emergency personnel, all else equal.

These studies advance disaster research by incorporating and engaging latent resources into disaster preparedness. They demonstrate the value of using an asset-based community readiness approach where existing social, built, and natural assets are used as a baseline for disaster preparedness. These resources can be strengthened through community-building activities to achieve resilience to various hazards.

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DEDICATION

To my mom, Nguyễn Thị Yeu, my dad, Nguyễn Van Khuê, the rest of my family and friends who love and support me.

Chapter 1: Introduction

Hazards research has long focused on the creation of vulnerability to disasters through the unequal distribution of resources across race, class, and gender (Blaikie, Cannon, Davis, & Wisner, 1994; Cutter, Boruff, & Shirley, 2003; Hewitt, 1983; Oliver-Smith & Goldman, 1988; Thomas, Phillips, Lovekamp, & Fothergill, 2013). Social vulnerability research has advanced our understanding of inequities and disasters; however, it typically fails to name racism, classism, and sexism as intersectional oppressions, while also failing to center community knowledge and encourage activism (Jacobs, 2019). People have capacities, skills, and knowledge that are often utilized following a disaster but are overlooked by planners and policymakers (Aldrich, 2017; Dynes, 2002; LaLone, 2012; Tierney, 2014). Voices of ordinary people, especially those who are marginalized, need to be heard and incorporated in disaster risk reduction activities. Disaster researchers, planners, and ordinary people can learn from each other and co-create new knowledge to collectively devise effective solutions to persistent problems.

In this dissertation, I examine disaster preparedness and mitigation through individual and community lenses using social capital, social vulnerability, and asset-based community development theories. In Chapter 2, I discuss the development and outcomes of an asset-based community readiness approach to help planners engage a community in local scenario planning that is asset-based, internally focused, and relationship-driven to reduce hazard risks in the long term given the uncertainty in the future. I ask, how can asset-based community development and storytelling techniques inform robust plans (that perform under a range of multiple future scenarios) and contingent plans (that perform under one or few scenarios) (Chakraborty, Kaza, Knaap, & Deal, 2011) for sustainable development? According to Chakraborty et al., contingent planning requires developing plans tailored to specific futures. This means, "if a future outlined in the plan does not materialize, the plan will remain unused; yet, without such a plan, one risks being unprepared" (2011, pp. 253–254). Robust planning entails producing plans for more likely outcomes under multiple scenarios. I present a case study from Plain, Washington to demonstrate how this approach can engage community members for collective action while developing robust and contingent plans for mitigating wildfires and subsequent flooding.

The next two chapters examine disaster preparedness for a Cascadia subduction zone (CSZ) event, which poses a significant threat along the Pacific coast of the U.S. and Canada. The CSZ has the potential to generate a magnitude 9 earthquake and trigger a tsunami, as happened in Japan in 2011. Such a scenario could kill over 10,000 people, injure over 30,000 people, and cause upwards of $70 million in economic loss in Washington, Oregon, and California (Cascadia Region Earthquake Workgroup (CREW), 2013). Chapter 3 explores the availability of latent everyday resources and how they can be used for a disaster. This study examines assets that are available on a day-to-day basis – specifically food, water, and social capital, to ask two questions. First, do measures of earthquake preparedness that take into account shared (community) resources suggest that different people and community types in Seattle are more prepared for an earthquake than do measures that only take into account individual household resources and capacities? Second, do measures of social capital predict disaster preparedness?

The study uses a survey experiment to test differences in preparedness between those who consider individual versus shared resources, called *individual disaster preparedness* (IDP) and *community disaster preparedness* (CDP), respectively. Taking these factors into account, the study explores how much estimates of preparedness might change if respondents were to take into account everyday supplies and social capital. Chapter 4 examines questions of fairness and trust in society and politics across different groups, and who people will rely on to share or distribute resources post-disaster. Also, given the expected demand for and delayed response from state and federal agencies (Oregon Office of Emergency Management, 2017; Washington Military Department, 2016), our research asks, whom will people turn to for help in a CSZ event, and why? The study examines by community type whether preparedness, fairness, and trust predict reliance on one's household members, people in one's neighborhood, and local professional responders (fire, police, and emergency personnel), and how reliance might depend on consideration of individual versus community preparedness.

These studies advance disaster research by incorporating and engaging latent resources into disaster preparedness. They demonstrate the value of using an asset-based readiness approach where existing social, built, and natural assets are used as a baseline for disaster preparedness. These resources can be strengthened through community-building activities to achieve resilience to various hazards.

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Chapter 2: Asset-based community readiness for fires and consequent floods in a wildland urban interface

Abstract

In this article, I apply an asset-based community development framework to a hazard mitigation project that blended scientific probabilistic modeling of scenarios with the local knowledge and human well-being values of a community to create stories about the community's future that address socio-ecological problems. Communities in the Western United States are experiencing larger and more severe forest fires as a result of climate change, fire exclusion, and lack of active resource management. Communities struggled to recover from fire and subsequent flooding. I discuss how stories of community assets, internally-focused initiatives, and relationships can enhance scenario planning for an uncertain future in the wildland urban interface. This approach allows communities to generate stories about the community's identity, values, and assets may help mobilize local people to actively engage with one another, devise solutions on the multiple ways to survive and evolve, while gaining local and political support for the strategies this process generated. More tangibly, robust strategies common to multiple scenarios can help with setting investment and policy priorities, and contingent strategies can help planners anticipate differing futures. Both types of planning can be guided by community values and assets to ensure that plans are relevant to community interests and capacities to evolve overtime. Multiple strategies and plans in place can help communities and planners alike to adapt more rapidly in uncertain and changing times.

Introduction

How would you like your smoke? This question was posed by participants to other participants in a hazard mitigation planning workshop focused on flooding following wildfires. The question was not about if or when the community would experience a wildland fire. It was about whether people were interested in mobilizing their tight-knit community to learn about the benefits of and to get buy-in for prescribed burns to reduce the likelihood of large severe fires and subsequent destructive flooding, or whether people preferred to do nothing and experience these inevitable and potentially catastrophic events. These decisions are not easy to make given the uncertainties of when, how, and where these events will occur and the tradeoffs that instituting mitigation actions entail, and yet, something needs to be done to reduce risks. In the Western United States, larger and more severe forest fires are a result of climate change, fire exclusion, and lack of active resource management (Abatzoglou & Williams, 2016; Littell et al., 2009). In this paper, I discuss how stories of community assets, internally-focused initiatives, and relationships can enhance scenario planning for an uncertain future in

an area where undeveloped wildland and human development meet, also known as the wildland urban interface.

In the era of climate change and pandemics, there has been a growing call to look at different options for the future to address complex problems (Crane & Landis, 2010; Forsyth, 2020). Traditional planning practices such as comprehensive and hazard mitigation planning often use a singular scenario based on community visions of growth for the future which includes the goals, objectives, monitoring, and evaluation to achieve the vision (Daniels et al., 2007). These planning practices generally do not account for uncertainty. Alternatively, urban planning scholars suggest using scenario planning as the way forward (Chakraborty & McMillan, 2015; Chapin, 2012; Klosterman, 2013; Norton et al., 2019). Scenario planning is "a systematic method for thinking creatively about possible complex and uncertain futures" (Peterson et al., 2003). Scenario planning produces multiple plausible futures, accounts for uncertainty, and can be used to rehearse different possible actions. Scenarios are not necessarily aspirational because not all futures are desirable and they also reflect processes of change (Hopkins & Zapata, 2007).

The process of change can be co-created by the community and planners. I argue that constructive scenario planning dialogue can be enhanced in the framework of what Kretzmann and McKnight (1993) called asset-based community development (ABCD). The framework has three interrelated principles which are asset-based, internally focused, and relationship-driven. The first principle, 'asset-based,' refers to identifying and mobilizing the existing community social and physical assets. The second principle, 'internally focused,' prioritizes community agenda building and problem-solving capabilities over external forces to stress the importance of local definition, investment, creativity, hope, and control. The final principle is 'relationship-driven,' and this focuses on people continually building, rebuilding, and maintaining relationships across social networks to drive internally focused community change (Kretzmann & McKnight, 1993). ABCD originally focused on community economic development, but the principles can be applied to other fields. Planners can integrate ABCD principles into scenario planning for hazard mitigation and the result could be scenarios that are "compelling, evidence-based stories about the past, present, and desired future embedded in scenarios with plausible plot lines can also set the stage for planning by creating a better future" (Klosterman, 2013, p. 164). I apply this approach and call it asset-based community readiness .

Planners have limited success at scenario planning, in part because the process is complex (Chakraborty & McMillan, 2015). Additional methods are still needed to engage the public in crafting scenarios from conception to tool development and implementation (Bartholomew, 2007); use community values to bridge scenarios with decision support and information provision (Avin & Goodspeed, 2020); and link plans, policies, and regulations for more desirable outcomes (Chapin, 2012).

In this study, I discuss the development and outcomes of an asset-based community readiness approach to help planners engage a community in local scenario planning that is asset-based,

internally focused, and relationship-driven to reduce hazard risks in the long term given the uncertainty in the future. I ask, how can asset-based community development and storytelling techniques inform robust plans (performed under multiple scenarios) and contingent plans (performed under only one or some scenarios) (Chakraborty et al., 2011) for sustainable development? I use a case study from Plain, Washington to demonstrate how this approach can be used.

Stories of Change in Scenario Planning and Asset-based Community Development

Scenario planning

Scenarios are stories about how the future might unfold inside plausible limits. Tracing the origins of scenarios, Bradfield et al. (2005) trace writings of philosophers such as Plato, Thomas More, and George Orwell to suggest that people have always been interested in the future, and they used scenarios as a tool to explore society and institutions of the future. Scholars believe that modern day scenario planning emerged in the post-World War II era where the military and government agencies used it to synthesize expert knowledge with simulation models (Bradfield et al., 2005; Leschine et al., 2015; Smith, 2007). They trace this work back to Herman Kahn at the RAND Corporation and later with his colleagues at the Hudson Institute in the 1950's and 1960s. Scenario planning became more mainstream when corporate planners used the techniques to analyze economic conditions for the Royal Dutch Shell company and anticipated an oil shortage and price increases (Wack, 1985). Military and business approaches to scenario planning approaches were merged with traditional land use transportation scenario planning that was based on federal environmental and planning mandates of the 1960s and 1970s including the continuing, cooperative, and comprehensive process required by the Federal-Aid Highway Act of 1962 and environmental impacts reporting required by the National Environmental Policy Act (NEPA) (Bartholomew, 2007). While scenario planning has been around for some time, the complexity of scenario planning may be one reason why planners are slow to incorporate and less than successful with scenario planning (Chakraborty et al., 2011; Chakraborty & McMillan, 2015; Chapin, 2012).

One of the major components of the scenario planning process is choosing a scenario type (Chakraborty & McMillan, 2015). There are different scenario types and classifications that vary based on purpose and how they are used. Börjeson, Höjer, Dreborg, Ekvall, and Finnveden (2006) find that scenarios can be typed as probable, possible, and preferable. They translate these scenario typologies into functional classifications. The new classifications focus on principal questions about the future. Scenarios classified as predictive ask, "*What will happen?"*, explorative scenarios ask, "*What can happen?"*, and normative scenarios ask, "*How can a specific target be reached?* (2006, p. 725)." Börjeson et al. explain that predictive scenarios aim to predict what will happen in the future. They are used for planning and

adapting to situations that are predicted to occur. *Normative scenarios* come in two forms differentiated by the system structure. Preserving scenarios examine how targets can be reached by adjusting the current system. Transforming scenarios examine how targets can be reached and find ways to get around barriers to achieving the desired results. *Explorative scenarios* examine situations and development that are possible. They are different from predictive scenarios in that they examine long time horizons to allow for structural changes to occur and start in the future. Determining what question communities would like to answer will determine which scenario type and classification will be used.

Planners are familiar with normative scenario planning as it is often used in comprehensive and hazard mitigation planning. Moving from normative to exploratory scenario planning, as used in the Plain case study, requires more time and complexity to integrate variables across a range of topics (Avin & Goodspeed, 2020). Normative scenarios are often used for decision support while exploratory scenarios are used for information provision (Ange et al., 2017). Exploratory scenarios can be more useful for planning when stakeholder values are incorporated into the understanding of quantitative analysis to promote better outcomes, and when scenarios are linked to existing plans, policies, and regulations (Avin & Goodspeed, 2020; Chapin, 2012; R. C. Freitag et al., 2014). As mentioned above, strategies emerging from the exploratory planning process can include *robust* plans that perform under multiple scenarios and *contingent* plans that perform under only one or some scenarios (Chakraborty et al., 2011). Contingent planning involves having a plan in place for each planned scenario which means that "If a future outlined in the plan does not materialize, the plan will remain unused; yet, without such a plan, one risks being unprepared" (2011, pp. 253–254). A robust plan, by contrast, is a single plan that will work under *any* of a range of possible future scenarios; the more divergent the range, the more robust the plan. Robust planning is more resilient to surprise (Peterson et al., 2003).

Asset-based community development (ABCD)

Needs-based approaches promote reliance on outside organizations for services and tend to reinforce feelings of dependency, inefficacy, and deficiency by low-income communities (Kretzmann & McKnight, 1993), as is evident from qualitative studies from South Africa (Nel, 2018). Asset-based community development (ABCD) developed by Jody Kretzmann and John McKnight (1993) is an alternative approach. ABCD is capacity-focused where capacities, skills, and assets of the community are centered in community development. The ABCD approach seeks to identify existing social and physical community assets for growing community development. Each community has a unique set of assets including the social capacity of individuals, associations, and local institutions. Individuals have gifts, skills, and capacities that can be unlocked and mobilized for community building. Individuals collaborate and coordinate with associations to solve problems or share common interests and activities. They enlist local institutions, often considered a formal part of the community, in internally focused community building. Mapping physical assets allow community members to appreciate what is already there and sheds light on underutilized assets that can be repurposed for positive community

change. Kretzmann and McKnight argue that once assets have been mapped, the key to neighborhood regeneration is to connect assets to multiply power and effectiveness in a way that engages local institutions in the work. The development process is then “asset-based, internally focused, and relationship-driven” (1993, p. 10).

Stories and Storytelling

Stories and storytelling are common in both scenario planning and ABCD approaches but less so in hazard mitigation planning (Freitag, Hicks, Jerolleman, & Walsh, 2020). ABCD approaches to mobilizing the community to align with the appreciative inquiry approach (Mathie & Cunningham, 2003). Appreciative inquiry promotes positive change by focusing on highpoint experiences and valuing organizational or community life (Cooperrider & Whitney, 2000). Appreciative inquiry can be effective at creating a shared history and vision for the future (Mathie & Cunningham, 2003). Like ABCD, appreciative inquiry shifts the conversation from ‘what’s the problem’ to ‘what’s good’. Instead of problematizing a community, the approaches elevate community strengths. ABCD takes this a step further by asking, based on what is good, ‘what can we do better, and ‘who do we need to engage to help us?

Scenarios are thought of as stories with a beginning, middle, and end (Ralston & Wilson, 2006). “At a high level of generality, the process [of building scenarios] includes four key steps: 1) brainstorming and discussing key trends, constraints, and issues; 2) identifying driving forces, categorizing them as assumptions or uncertainties, and rating their degree of uncertainty and impact; 3) selecting the driving forces with the most uncertainty and highest potential impact to serve as the basis of the scenarios; and 4) building the scenarios based on the driving forces” (Avin & Goodspeed, 2020, p. 405). Driving forces can be internally focused on forces that can be controlled or influenced by policies or externally focused on factors over which humans have little control. A common approach is to select two driving forces and examining the interaction between them on a 2x2 plot (Figure 2), thus creating four different scenarios (Leschine et al., 2015). From here participants in the scenario planning process examine the interaction between the drivers, extrapolate consequences, highlight critical events, and incorporate conflict to develop stories for each alternative future scenario (Ralston & Wilson, 2006). Through storytelling, there is the potential to make discoveries which usually happens at the end of the storyline (Lewis, 2011, p. 506). Stories have a transformational effect as those who hear the stories take up the challenge outlined in the stories (Iseke, 2013, p. 573).

Flooding risks following wildfires: A case study in Plain, Washington

Flooding and wildfires

In 2014 and 2015, Washington State experienced the largest wildfires in the state’s written history up to that point burned over a million acres, half of that total in two fires alone. Flash

flooding and mudslides followed (Godwin, 2020), and communities struggled to recover from the tandem disasters.

Because natural fires help maintain forest health, structure, diversity, and function (Agee, 1993), human interventions in the wildland urban interface such as land-use change and fire suppression have minimized the benefits of fire and reduced forest health. The nature of wildfires depends largely on topography, climate, and vegetation (Collins & Stephens, 2010; Falk et al., 2007). Changing one of these controls changes the fire effects on the landscape. Fires change the landscape above-ground and below-ground. Fires physically alter soil composition and can change the hydrological response of the watershed by creating water repellent soils (Neary, Ryan, & DeBano, 2005, updated 2008). These soils, in turn, can decrease infiltration and increase runoff and erosion (Certini, 2005; Robichaud et al., 2000).

Among ways of making the wildland urban interface resilient to fire, dual treatments of mechanical thinning (reducing vegetation) and prescribed burns have been shown to be the most effective (Allen et al., 2002; Franklin et al., 2008; Hessburg et al., 2005). Mechanical treatments remove ladder fuels, vegetation that allows for fires to move up to tree crowns and which increases the distance from the forest floor to the crowns and between crowns (Agee & Skinner, 2005). Periodic prescribed burns then maintain the openness of the mechanically treated forest floor. As a result, fires remain grounded and do not easily spread to the canopy; more of the trees survive (Stephens et al., 2012) and the survivors include large-diameter, fire-resistant trees (Agee & Skinner, 2005).

When fires do occur, post-fire treatments in the forest are vital for mitigating subsequent hazards such as flooding. Forest rehabilitation and restoration treatments can include soil stabilization to prevent erosion, flood control, water quality assessments, and reforestation strategies. For humans, these become more important where increasing numbers of people are living and recreating in the wildland urban interface.

On the urban side of the interface, communities can protect society and the built environment by implementing Firewise activities (see more https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA) and expand Fire Adapted Communities (FAC) concept to the whole community (see more https://www.fireadaptedwashington.org/). Firewise is a program focused on residents reducing wildfire risk by managing vegetation around the home, using fire-resistive construction, and being prepared to allow emergency responders access to the property. These activities are most effective when all property owners take these actions which would result in a more resilient community. FAC focuses on learning how to live with wildfires and using a holistic approach to mitigating disasters as a community from the local to federal levels. Firewise and FAC approaches can be driven by grassroots and government-organized groups.

In 2017, FEMA Region X funded the Cooperating Technical Partners Flood Risk Project for University of Washington Institute of Hazards Mitigation and Planning Research (IHMPR) to investigate risk reduction measures for robust and contingent[1] plans for the wildland urban interface that look ahead to increasingly frequent floods that follow wildfires as Earth's climate warms. I was one of seven members on an interdisciplinary research team comprised of forestry, statistical, and urban planning scholars. I use this case study to discuss the development and outcomes of an asset-based community readiness approach to scenario planning. Throughout the project, the team took steering committee meeting notes, workshop notes, conducted interviews on the phone or email, and implemented a post-workshop survey. I use all of this information along with the technical report (R. C. Freitag et al., 2017) to describe the case study in the following sections.

Plain, Washington

Plain, Washington, east of the Cascade Range in an unincorporated part of Chelan County. adjoins the Wenatchee River downstream of the tributaries that head in the Cascades. The Plain watershed (Figure 1) is one of the few areas in the eastern Cascades that has not experienced a major wildfire.

Steep and unstable slopes, floodways, and other areas make the area unsuitable for widespread development. Hence development is primarily concentrated around two lakes and a transportation corridor. Most of the land in the study area is owned and managed by the United States Forest Service. A little over 2,500 people live in areas zoned Rural Residential (Chelan County, 2016).

[1] In the IHMPR report, the authors use the term path dependent instead of contingent, but they mean the same thing.

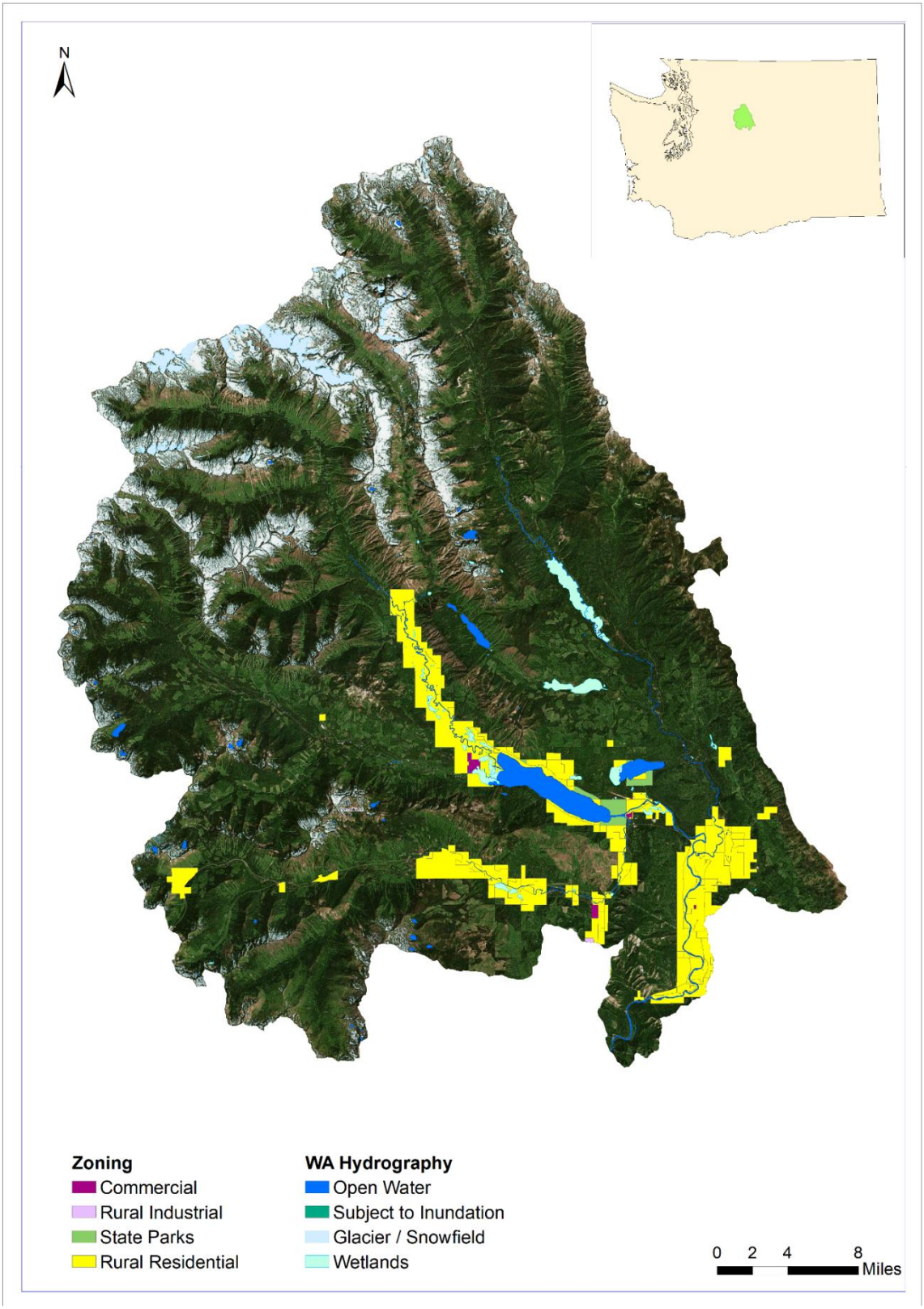

Figure 1. The Plain watershed is the study area. Outside of the WA hydrology and zoned areas is forested land. (R. C. Freitag et al., 2017)

Scenario planning process

IHMPR partnered with the County to determine a study area and identify a steering committee comprised of regional fire and flooding experts to help guide the research study. The first steering committee meeting was convened on January 13, 2017, to understand flooding following fire risks in Chelan County and to identify potential study areas. The committee selected Plain as the study area because of the risks, increasing local and recreational population, and the lack of studies. The second steering committee was held on April 28, 2017, at the Lake Wenatchee Fire and Rescue District office. The steering committee recruited from the auxiliary fire department and local business owners to learn about the study and gain their buy-in to participate in the study. Plain stakeholders agreed to be active participants in the study and were incorporated as members of the steering committee.

Fire and flooding were selected as the external driving forces of change and population growth was selected as the internal driving force of change. The research team developed four alternative futures (Figure 2) over 60 years based on the driving forces to identify risk reduction strategies. The alternative futures were (will be described in further detail later in the paper):

1. **Local Renewal**: population decreases following major fires and flooding events;
2. **Community Transformation**: population increases despite major fires and flooding events;
3. **Local Reorganization**: population decreases as fire and flooding threats increase, but no major events occur; and,
4. **Reactive Management**: population increases as fire and flooding threats increase, but no major events occur.

With these scenarios, the IHMPR team calculated fire and flooding risks for each scenario. A technical report spells out methods for calculating fire and flooding risks and population change over time (R. C. Freitag et al., 2017). I provide a summary here.

The steering committee wanted to explore long-term changes in the wildland urban interface. This meant extending the timeline beyond the standard 5–20 years planning timeframe in the comprehensive and hazard mitigation planning to be able to observe long-term forest ecosystem changes. The steering committee and research team decided on a 60-year timeframe starting with 2020 as the baseline year. The reference risk map was calculated for the year 2020 (Figure 3) and was used to ground the analysis and analyze the results (Knaap et al., 2020). Each color of each grid represents the amount of area that is predicted to burn at high severity if a fire occurred at that location. The predictions are averages of both model components – fire size and percent burned at high severity – across the year and climate. models. The darker the brown color the higher the risk. The county's zoning and hydrology for Plain are overlayed on the fire risk map. One out of the three highest fire risk areas are in a population center near important waterways. Fires and flooding occur in Local Renewal and Community Transformation scenarios in years 2040 and 2080 (Figure 4-7). Flooding damage

and extent were calculated using FEMA's HAZUS program. After fires of 2040 and 2080 in the Local Renewal and Community Transformation scenarios, 316 and 1,759 buildings, respectively, are damaged by flooding in the southeast Plain watershed. Fuels accumulate by 10% for each scenario year but no fires or flooding occur in the Local Reorganization and Reactive Management scenarios (Figure 8-9). At the time of the exercise, the projected population for the baseline year of 2020 was 2,833. Future population ranged from a "bust" scenario of 2,238 to a "boom" scenario of 5,747. In scenarios where population booms, local zoning codes will need to be updated to accommodate more people

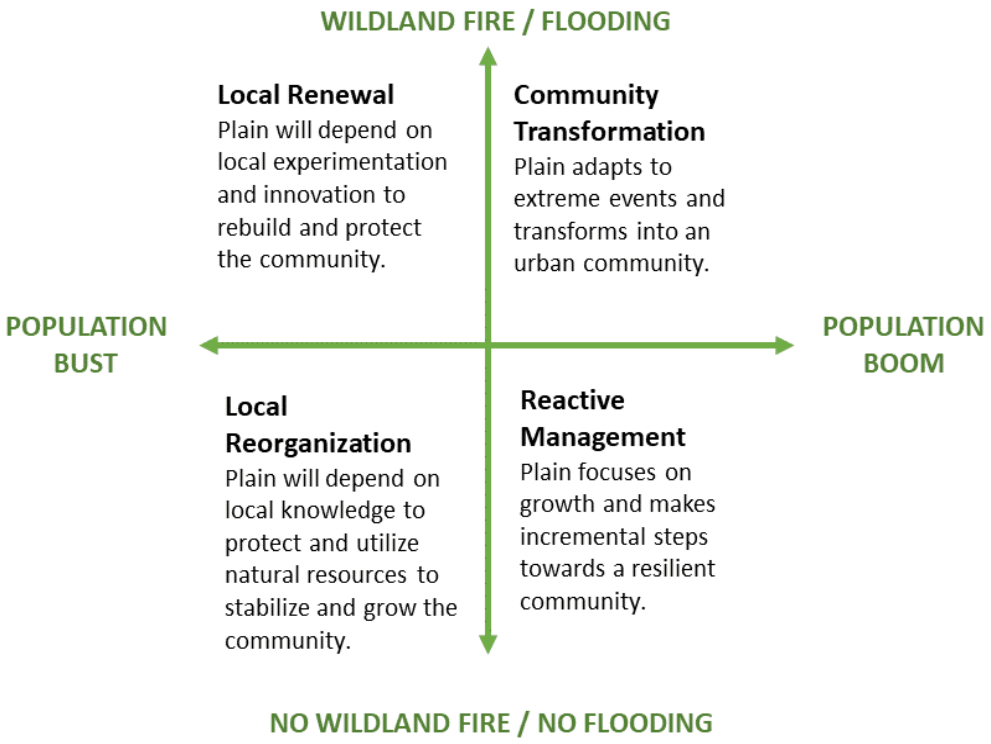

Figure 2. Four alternative futures (R. C. Freitag et al., 2017)

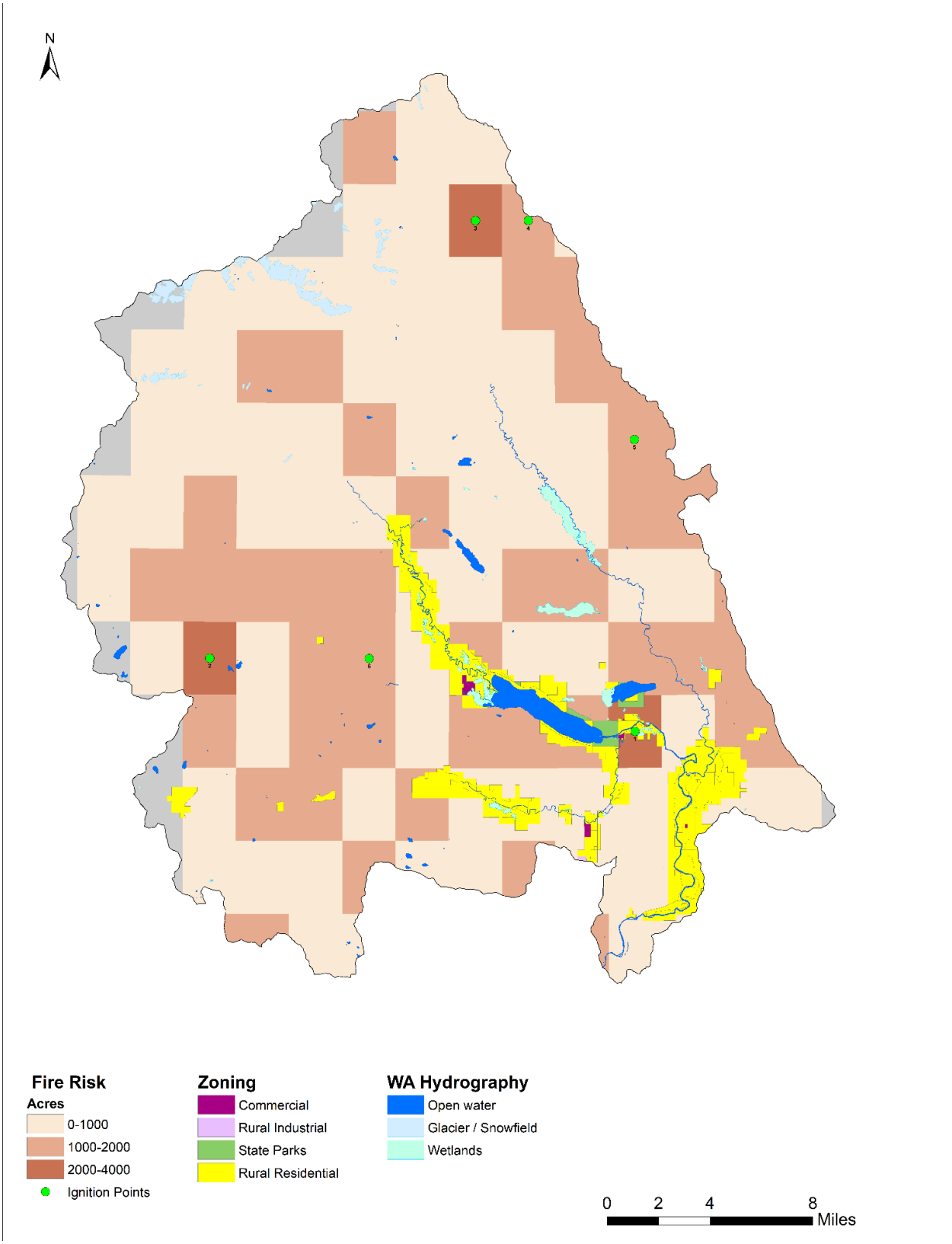

Figure 3. 2020 fire risk base map with zoning and hydrography (R. C. Freitag et al., 2017)

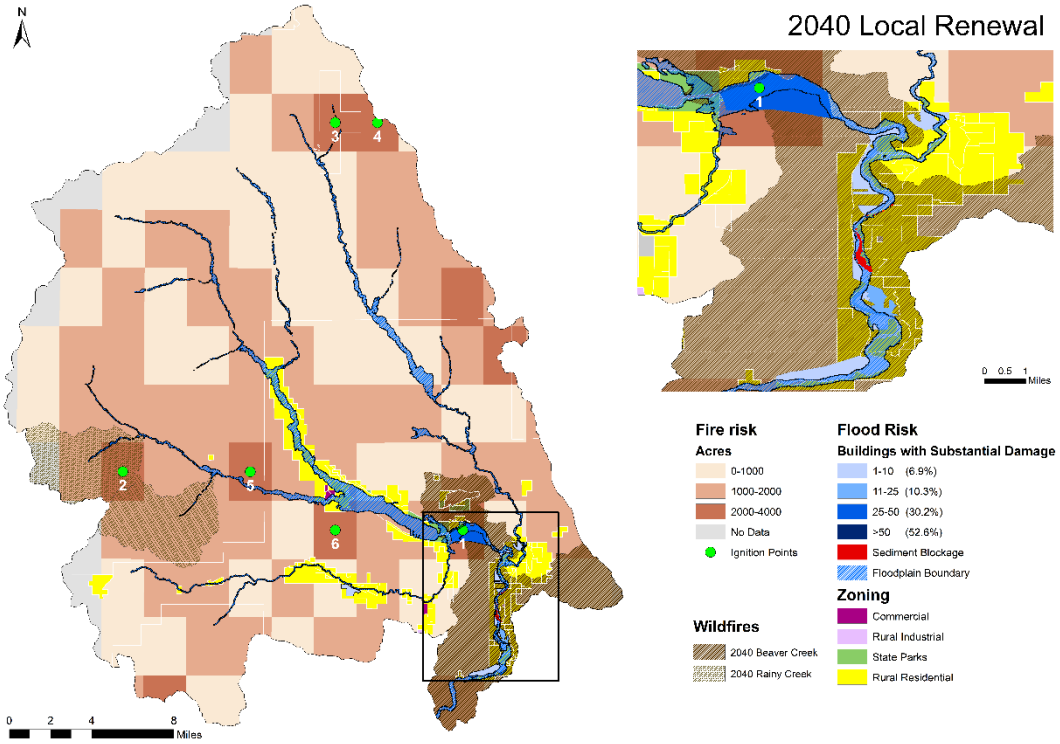

Figure 4. 2040 Local Renewal (R. C. Freitag et al., 2017)

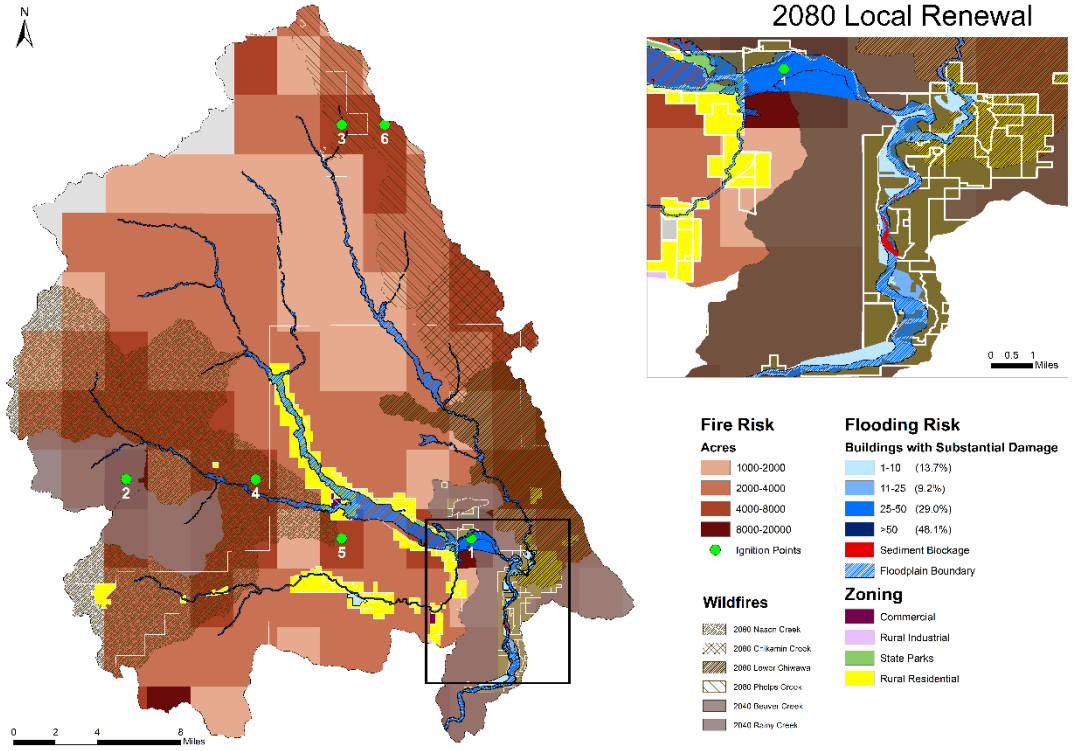

Figure 5. 2080 Local Renewal (R. C. Freitag et al., 2017).

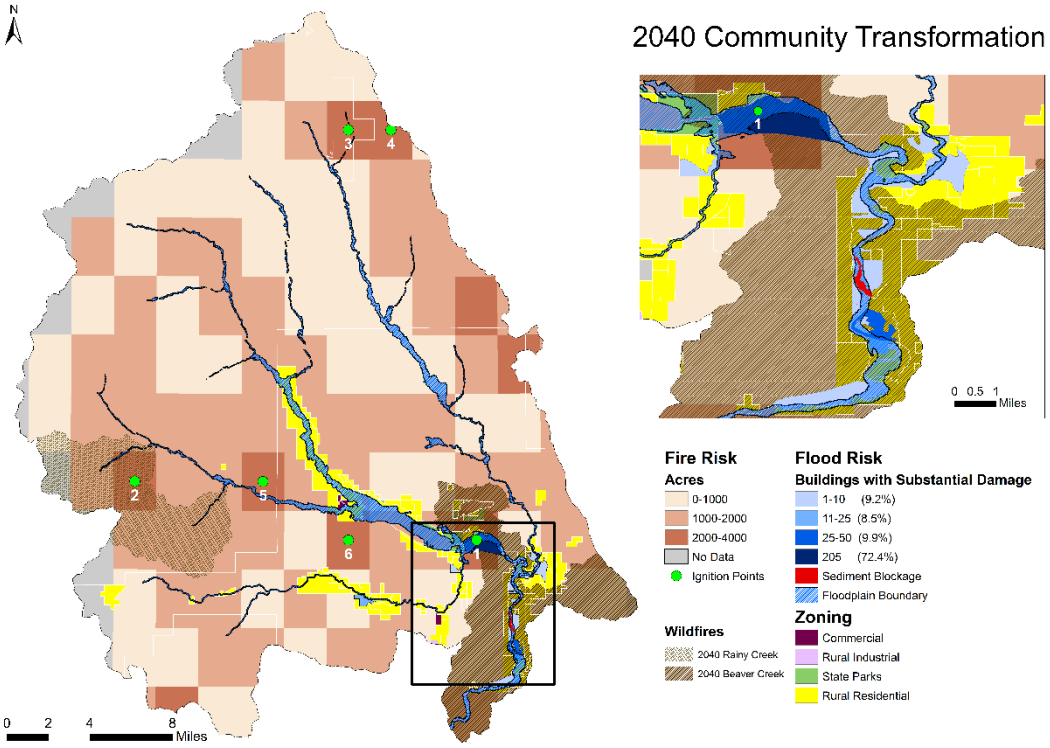

Figure 6. 2040 Community Transformation (R. C. Freitag et al., 2017).

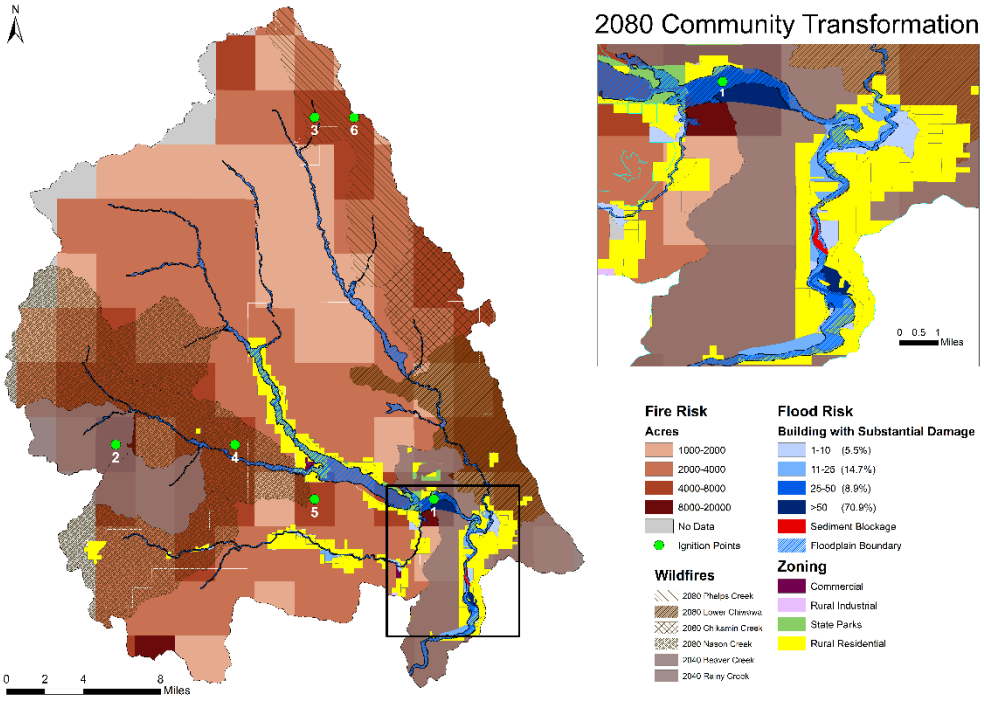

Figure 7. 2080 Community Transformation (R. C. Freitag et al., 2017).

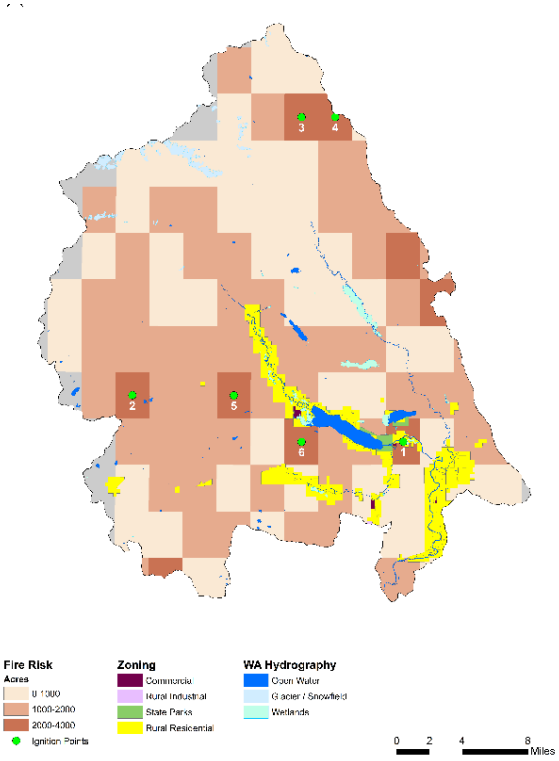

Figure 8. 2040 Local Reorganization and Reactive Management (R. C. Freitag et al., 2017).

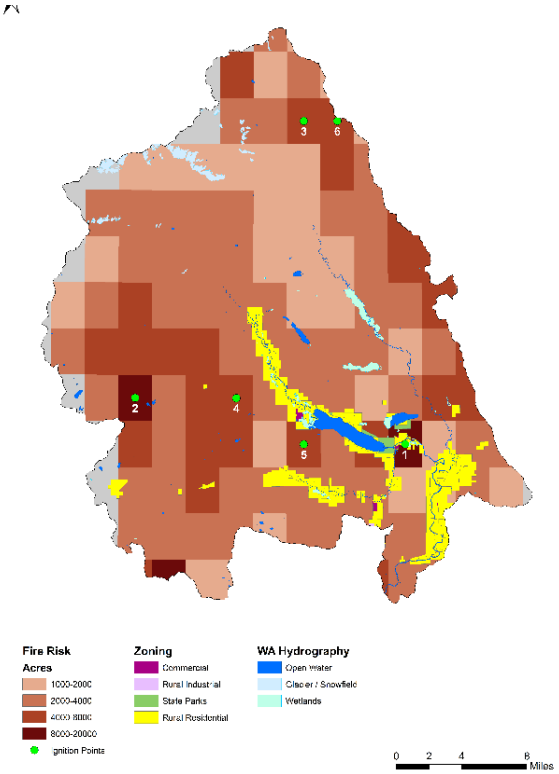

Figure 9. 2080 Local Reorganization and Reactive Management (R. C. Freitag et al., 2017).

Community Workshop

The IHMPR continued elaborating on the scenarios with the community during a workshop on June 2, 2017. Plain stakeholders were invited to attend the workshop. The meeting was advertised by posting flyers in the community and putting an announcement on the local fire station website. The meeting was open to the public. Thirteen people participated in the meeting at the Lake Wenatchee Fire and Rescue District office (Figure 10). Participants included homeowners, business representatives, firefighters, medical personal, conservation non-profits, Firewise and FAC representatives, and local and state land managers. While the number of participants was small, a diverse set of people were in attendance, and many wore multiple hats. It is notable that many participants were both residents of Plain or the neighboring area and were affiliated with other organizations. Two notable groups missing from the discussion were vacation rental homeowners who own property primarily around Lake Wenatchee and representatives from the United States Forest Service, the largest landowner in the study area.

The community workshop consisted of three rounds of activities framed around ABCD and storytelling methodologies (Figure 11). Each group of participants was given large worksheets to use as a guide for discussion and as a space for participants to take notes on (Table 1-2)[2]. After each round of ABCD discussion, one participant would share their group's discussion using a storytelling format and researchers took notes on large posters for everyone to view.

Round 1: Story context

Every story has a beginning. In Round 1, participants created the story context in three steps. Using an ABCD approach, workshop facilitators first asked, what do you like about your community? What makes the community great? These questions were focused on determining what people valued about living, working, and recreating in Plain. Participants were then asked to identify what "things" provided what they value. Things included houses, roads, bridges, built systems (built capital); viewscapes, trails, and wild animals (natural capital), and people, relationships, associations, and networks (social capital). This connected social and physical assets to the things they valued in the community. Facilitators then asked, what would make your community even better?

Next, participants reviewed the 2020 Plain base map (Figure 3) and were asked to gain familiarity with the fire risk in the watershed and what capitals could be impacted during fire and flooding events. Finally, participants were asked to create goals and objectives for reducing risks or exploiting opportunities in the community, forest, and floodplain. When that was

[2] The worksheets in the main body of the paper were lightly edited for paper clarity and to reflect what happened in the workshop. The worksheets used in the workshop are in the Appendix M.

Figure 10. Community workshop

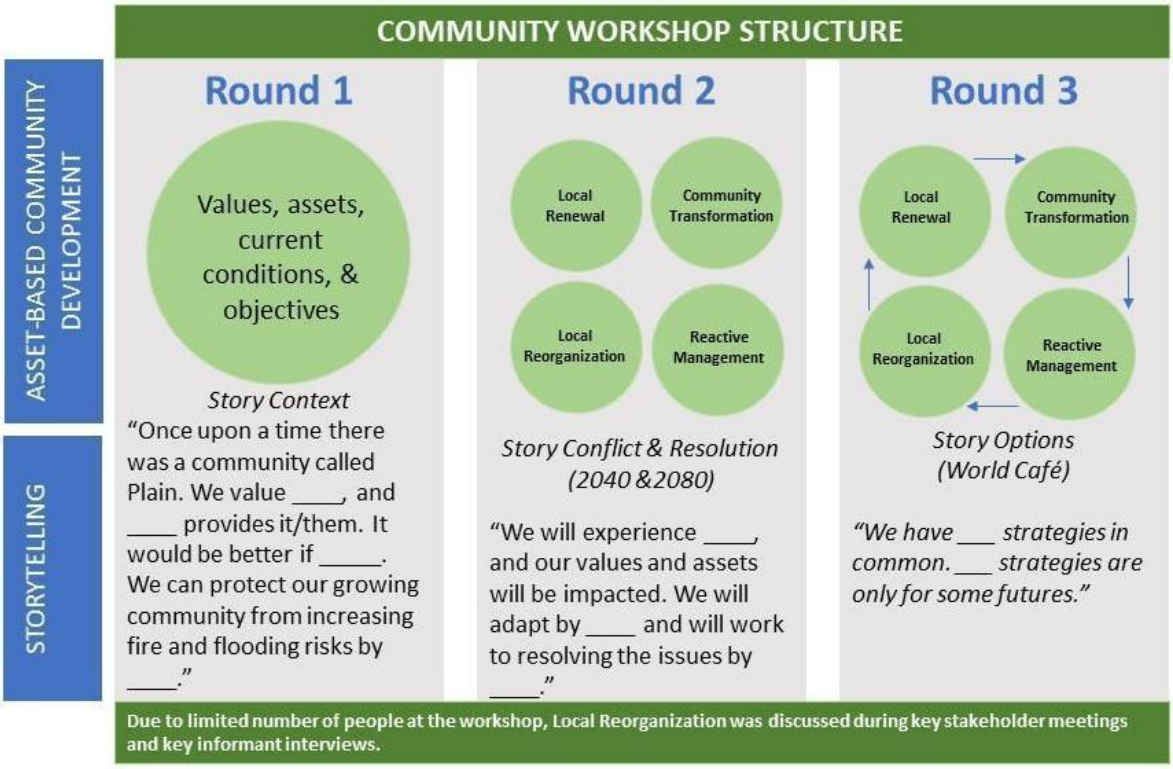

Figure 11. Community Workshop Structure

complete, the participants created a collective story about their community using the information derived from the discussion.

Round 2: Story conflict and resolution

In Round 2 participants sat at different tables and were assigned to discuss one of four different alternative futures[3]. In other words, each table was assigned to discuss one scenario for the years 2040 and 2080. At the heart of the story, conflicts are the fire and flooding risks and population change. Facilitators presented the 2040 scenario risk maps to open discussion about the location, severity, frequency, and timing of the events or an absence thereof. Participants discussed the impacts on local capitals, what is remaining after the disaster, how the community's daily life changed, and discussed new objectives. Then participants worked on finding a resolution to the story conflict identifying approaches and tools to improve the community and reduce risk. Participants were also tasked with identifying individuals, associations, or local organizations who would be responsible for implementing mitigation strategies. Each table presented its findings to all the workshop participants in a storytelling format. The same process was followed when the 2080 scenarios were introduced.

Round 3: Story options

The final stage of the story development process involves a discussion about the many strategies that emerged in each scenario. This round of discussion intended to talk more in-depth about the strategies with other participants in the workshop, iterate on the ideas through dialogue then identify what strategies were the same across different scenarios (robust) or only relevant to one or few scenarios (contingent). Using the World Café method (Fouché & Light, 2011), participants rotated from one table to the next to learn more about each scenario and provided feedback on the strategies. One person stayed behind to share information about the scenario and strategies with other participants. This person shared their final findings in a storytelling format. As each story was being told out loud, notetakers wrote down the story on a large board for everyone to see. After all the stories were told, participants could see where there were common strategies in all scenarios and strategies that only applied to some scenarios.

The story options were refined by the IHMPR team upon further analysis, follow-up phone calls and emails with the Steering Committee, one survey to workshop participants to clarify strategies, and additional research.

[3] To maximize discussion with the number of participants at the workshop, facilitators split the participants into three groups. Local Reorganization was role-played by IHMPR team after the workshop and confirmed the results with the steering committee later.

Table 1. Worksheet #1: Story Context

ROUND 1: STORY CONTEXT				
VALUES AND CAPITALS (ASSETS)		**2020 PLAIN BASE MAP**		**OBJECTIVES**
Your values	Things that provide what you value (capital):	HAZARD (CHANGE) Location Severity Frequency Timing	IMPACTS TO CAPITAL (+/-) Built Natural Social	Reducing Risk / Exploiting Opportunities to: Community Forest Floodplain
My community is great because:	Built: (houses, built systems…)	Notes:	Notes:	Community
It would be even better if:	Natural (view, slope…)			Forest
	Social (networks, relationships...)			Floodplain
Instructions: Using the prompts above, discuss community values and what provides it/them in Plain. Write down your ideas and circle the most important ones.		Instructions: Review the topography (Figure 1) and 2020 Plain maps (Figure 2), discuss the hazard conditions and the impacts on different types of capitals. Use this space to log your thoughts.		

Table 2: Reducing Risks (Exploiting Opportunities) Through Story Telling

		ROUND2A. STORY CONFLICT			ROUND 2B. STORY RESOLUTION			ROUND 3: STORY OPTIONS
		Introduce scenarios, new normal, objectives, and risk reduction/opportunity for enhancement						**Robust and contingent risk reduction strategies**
Scenario Event: _____ HAZARD (Change): 1. Location 2. Severity 3. Frequency 4. Timing	IMPACTS to capital: 1. Natural 2. Built 3. Social	New Normal Providers of Goods and Services: After a disaster what things (capital) are available to provide the goods and services you value? Built (houses, built systems…) Natural (view, slope…) Social (networks, relationships…)	New Normal: How has your community's daily life changed?	Objectives Revisited Reducing Risk / Exploiting Opportunities to: 1. Community 2. Forest 3. Floodplain	Risk Reduction / Opportunity Enhancement Approaches and Tools: Knowing what you now know, how would you improve your community? What would you do? -Protect -Adapt / Accommodate -Relocate – Move to a safe place	Responsibility: Who should be responsible for implementation? 1. Family 2. Neighborhood 3. State 4. County 5. Non-Profit (Church, YMCS, Red Cross) 6. Other	Parking lot / Questions	World Café Identify one person to share strategies and stay at the table. Other people move around to each table to learn about strategies in each scenario. Provide feedback.
Instructions: Feel free to make notes in columns (unique circumstances)		Instructions: 1. Circle the most important (top three) 2. Feel free to draw lines.						

Results

These are the exercise results for each round of discussion in the workshop.

Story context: Collective community story

The five salient values that emerged from the workshop discussions were the close-knit community, natural features, rural characteristics, year-round recreation, and infrastructure. Relationships between residents, associations, and local institutions were identified as assets to the community along with the natural and built environment. The collection community story began with the following statement:

*"Once upon a time there was a community called Plain. We are a unique and caring community. We value a **close-knit community** where residents, business owners, and government officials regularly interact to strengthen the community. We participated in local events such as school activities, Thursday night dinners, and yard sales at the Beaver Valley School and Plain Community Church and Pantry. We exchange information at the hardware store and act to protect the community through Firewise and FAC activities. We engage with local to federal government land management agencies to focus on community needs. We value the **natural features** of the Cascade mountains. The forest ecosystems provide beautiful landscapes for people to enjoy and for natural systems to function. We value the **rural characteristics** such as large land lots and a low population that give the community a rural character. Locals and visitors both value the **year-round recreation** in and around Lake Wenatchee, Fish Lake, and two state parks. Adventurers of all ages enjoy nature walks, fishing, kayaking, horseback riding, snowmobiling, zip-lining, hiking, hunting, and more! Most of the land in the Plain watershed is designated at National Forest and development is primarily along the lakes and transportation routes. We value the **infrastructure** that connects us to the forest and human settlements by trail, road, and internet."*

Things that would make the community better included development for younger generations and protection of existing built and natural environments. Participants expressed a need for more affordable housing, jobs, greater commitment from vacation rental homeowners, and improved natural resource and infrastructure management. They said,

"It would be better if we had more affordable housing coupled with more jobs. We want more young people and families to stay or move to our community to balance out our demographics. We hope that people will stay for the long-term so we can pass on our local knowledge. Our community assets are plentiful, but we need the appropriate housing and jobs to retain and attract young people. We would like a greater commitment from vacation rental homeowners to maintain their properties and encourage better behavior from vacationers. We would also like to see better natural resource and infrastructure management to preserve, protect, and enhance the forest and infrastructure."

Based on what the community valued and what they wanted to make better, participants reviewed the 2020 fire risk base map to understand the risks near the local community and waterways. They developed goals and objectives. They ended their collective community story by expressing the following:

"We understand that our community is under threat from forest fires and flooding. The forest is getting drier, and fuel continues to build. We experience smoke from fires outside the Plain watershed and know that we can be next. We are worried for ourselves as well as for people who recreate here and for future generations.

Our goals are to maintain our close knit-community through informal and formal community engagement activities; preserve the natural features, sustain the rural character of Plain, maintain and in some areas, increase infrastructure systems to sustain human well-being, and enhance safety; and improve year-around recreation.

Our objectives are to preserve a healthy forest, reduce risk to life and property, reduce post-fire hazards to life and property, and reestablish healthy forests in burnt areas."

The collective community story set the foundation for exploring strategies under four alternative futures and for devising recommended actions that would improve each future.

Story Conflict and Resolution

The hazards in each of the four scenarios presented a different story conflict. In Local Renewal and Community Transformation, fire and flooding occurred in the years 2040 and 2080. The acres burned in each scenario were the same, but the flooding damage was different because in Local Renewal the population decreased over time resulting in no new infrastructure whereas population growth continued over time in Community Transformation resulting in additional infrastructure hence, more buildings were damaged. In all four scenarios forest fuels built up by 10 percent in years 2040 and 2080, but there were no fires and flooding in Local Reorganization and Reactive Management scenarios. Participants reviewed the story conflict, discussed the impacts of the hazard on community values and assets expressed in Round 1 of the discussion, and resolve the conflict by devising strategies for risk reduction or community enhancements. The story for each scenario is as follows:

Local Renewal

"We experienced fire and flooding events in 2040 and 2080. Our population remained steady until 2040. After the disasters, the population started to decrease because the natural features and infrastructure were destroyed. We adapted and resolved our issues in many ways. Our close-knit community became smaller, but the remaining residents became closer as we experimented with new forest management techniques and continued with Firewise and FAC approaches. We galvanized to advocate and lobby our local, state, federal political

representatives to address local needs. We need land management agencies to work in partnership with private landowners and community-wide to create a fire-resistant community. This means better forest management (e.g., tree thinning and prescribed burns to reduce forest fuel, post-fire rehabilitation), local emergency management, and upgrading and enforcing building codes. Some unburned areas can still be utilized for recreation, but rental property and businesses were destroyed, resulting in tourism decline. The school is at risk because of the declining population. Year-round recreational activities changed over time to adapt to the new landscape and climate conditions. More game species were attracted to grasslands, and hunting interests increased. Road and internet infrastructure were repaired over time. Since there is no pressure to develop, no new housing is built, and the rural character remains intact. Fires and flooding in 2080 might be the death of the community as we know it."

Community Transformation

*"We experienced fire and flooding in 2040 and 2080. We were highly adaptable and resolved our issues rapidly. The **close-knit community** begins to change as people move away and are replaced by people from the outside. We reestablished our community and fostered community care. Stewardship groups are managed at the municipal level rather than at the grassroots level. We will spark interest in a central plan for emergency management called, 'One Team One Plan in Service to the Greater Community'. Despite these disasters, we adapted to new climate conditions and the population steadily increased over the years forcing the County to update zoning codes to accommodate growth. This is good for builders. Local businesses were impacted by the disasters, but new businesses supported recovery. Tax revenue increased which led to faster repair and construction of **infrastructure**. The fire auxiliary service was replaced by a professional government-funded fire department. Urbanization threatens the **rural character**. We need to protect and restore **natural features** from further harm (e.g., tree thinning and prescribed burns to reduce forest fuel, post-fire rehabilitation). We are especially worried about local plant species and endangered animals. We need cooperation from all agencies to enhance forest management. Flooding becomes a greater risk because of the fires. A change in **year-round recreation activities** helped people stay active while enjoying the outdoors. Innovative forest and floodplain management techniques were developed to adapt to new climate conditions, the community changed after each disaster and transformed into something new."*

Local Reorganization

*"We experienced 10 percent forest fuel build-up from the year 2020 to 2040 and again from 2040 to 2080. The **natural features** were significantly altered due to the increase in forest fuels. Consequently, the Plain watershed is at risk of severe wildfires and subsequent flooding. The **close-knit community** eroded as people moved away. We need to foster neighbor-to-neighbor relationships and partnerships to rebuild our social networks. We try to maintain forest stewardship programs as best we can. There is no pressure to develop new **infrastructure** because people are not staying in our community. We experienced decreasing tax revenue which made it difficult to keep up with infrastructure maintenance. Lower tax revenues also*

*made it harder for forest management agencies to make improvements. State and federal funding for risk reduction efforts are sporadic at best. The **rural character** of Plain is preserved. **Year-round recreation** has not changed much as there are many trails to explore. Hunting and fishing have not been drastically influenced by wildland fires, although some grassland game species became less abundant. We exploited the natural features to attract visitors and increase revenue for the town as best we could."*

Reactive Management

*"We experienced 10 percent forest fuel build-up from the year 2020 to 2040 and again from 2040 to 2080. The **natural environment** has been significantly altered due to the increase in forest fuels. Consequently, the Plain watershed is at risk of severe wildfires and subsequent flooding. Hunting and fishing were largely not influenced by increased fuels. People continue to enjoy these activities. The **close-knit community** value eroded as more people settle permanently in the area. We adapted by establishing stewardship programs managed by the municipal government to strengthen participation in Firewise and FAC while enhancing community connections. The County constructed new infrastructure, established a professional government-funded fire departments, added health services, and other government services in Plain. The government focused on growing the community, updated zoning codes to accommodate more people, updated building codes to mitigate against disasters, and implementing reactive forest management policies. Fire risks were reduced through the development of land. Land management agencies were slow to implement proactive forest fuel reduction measures. More and more people came to **recreate year-round**. New trails, roads, and high-speed internet **infrastructure** made it easier for people to come and go. We continue to seek grants to establish a small diameter mill to process timber from thinning operations. This will increase employment opportunities for locals and improve forest health. The **rural character** of the community was diminished with population growth."*

Story options

Each group of participants considered building and maintaining social capital. They examined how population changes would alter social relations and people's ability to reduce risks to hazards to protect their communities. In scenarios where the population decreases, the community becomes even closer because they have fewer people to rely on and must work together to maintain a sense of community. In scenarios where the population grows, participants were reluctant to accept population growth because a larger population would threaten the rural character and strong social connections. Participants in the Community Transformation scenario eventually accepted that more people would reside and recreate in Plain. They were determined to adapt their values and embrace change. They focused on reformulating community relations to drive a *One team One Plan in Service to serve the Greater Community*. Participants in the Reactive Management scenario were more reluctant to accept population growth and struggled with visioning a community with strong grassroots social

connections. They were more open to having the municipality organize the community. No matter how the community was organized, all scenario groups expressed a need to continue Firewise activities and apply FAC concepts to the whole community. Both programs can be driven by grassroots and government-organized groups. Participants also expressed a desire and need for more local emergency management planning including establishing fire and flooding safety zones for safe assembly during an event. When communities in the wildland urban interface are fire resistant and the community is prepared to respond, firefighting resources can focus on preventing forest fires from coming closer to human settlements.

Engaging local to federal institutions depends on developing and maintaining relationships to drive change. Residents were keenly aware that they need cooperation from various land management agencies to plan for development and maintain systems effectively. Participants in the Local Renewal scenario were most explicit about this when they said, "*We galvanized to advocate and lobby our local, state, federal political representatives to address local needs. We need land management agencies to work in partnership with private landowners and the overall community to create a fire-resistant community. This means better forest management (e.g., tree thinning and prescribed burns to reduce forest fuel), local emergency management, and upgrading and enforcing building codes."* All scenario groups desired more protection for the built and natural capitals. Participants expressed the need to advocate for stricter building codes and grants for retrofitting, restricting development to preserve the natural features, and protecting critical infrastructure. In addition, participants expressed the need for state and federal forest services to implement landscape treatments in the forest. These treatments include prescribed burns, fuel breaks, and thinning. All these measures are proven to reduce fire risk in the wildland urban interface and mitigate against flooding. Finally, all scenario groups struggled with how to thin the forest of ladder fuels without having a lumber mill in the area, mills had shut down when logging in the area decreased during the last 40-50 years. The Reactive Management scenario group came up with the idea of establishing a public-private small-diameter mill. This was a creative and innovative strategy that could also provide jobs for the local community, something they think would make the community better.

In scenarios where population increases, communities should consider contingent plans that increase fire and flooding risk. Accommodating additional growth in Plain will add to the urban footprint in the wildland urban interface. While this may be desirable for growth scenarios, once the land is developed, the development becomes difficult to remove if the population decreases or the development is no longer desirable. In the Reactive Management scenario where growth is high and land managers react to events instead of being proactive, this difficulty could have consequences for both human populations as well as nature. In scenarios where the population decreases, land managers need to find innovative ways to implement proactive mitigation actions before and after fire and flooding events without a strong tax base. Mitigation actions cannot wait for the tax base to increase. The community and government could experiment with new techniques and secure funding from higher levels of government or foundations to implement mitigation actions.

In scenarios where fire and flooding occur, close attention to the landscape will be critical for protecting human settlements as well as the forest for regeneration. Lack of post-event mitigation actions can be devasting for the community and forest. Post-fire event mitigation actions include soil stabilization to minimize soil erosion and increase flood control. Protecting burnt areas from large animals is also important as they can destabilize the soil and increase the chances of flooding.

Case study limitations

There were some limiting factors in our case study. First, because the workshop coincided with fire season, fire authorities were responding to incidents and were not available to attend the workshop. The largest landowner, the United States Forest Service was not in attendance. There were questions about protections for spotted owl and salmon habitats that were unanswered in the workshop and could have been addressed by the appropriate Forest Service personnel had they were present at the meeting. Another gap in attendance was vacation rental homeowners. They are important stakeholders whose actions or inaction directly affect the rest of the community. Workshop participants expressed concern that vacation rental homeowners had slight property maintenance, specifically the clearing of fire fuel. If some vacation rental property homeowners were present, they could have suggested strategies for better maintenance such as creating a property management company responsible for limiting fuel build-up on rental properties. Another limitation was that the workshop was conducted only once in the community. To get a better representation of different groups, hosting the exercise a couple of more times on different hours and days of the week would have resulted in more data for us to analyze and develop more strategies that reflect the whole community. Many other case studies share such deficiencies in their engagement with stakeholders (Oteros-Rozas et al., 2015).

Conclusion

Comprehensive plans articulate a community's land use goals and aspirations based on growth predictions. Hazard Mitigation plans, at best, are aligned with comprehensive plans and focus on reducing natural hazard risks to communities. Both types of plans focus on the short term and follow a linear planning process that does not account for uncertainty and surprises. In contrast, in our research, we developed scenario planning, asset-based community development, and storytelling methods that blended scientific and local knowledge to examine long-term risk reduction strategies over multiple alternative futures.

The County of Chelan Comprehensive Plan has subsections for different study areas throughout the county. The Plain-Lake Wenatchee Study Area vision statement (Chelan County, 2016) is similar to the one articulated in the community workshop. The Comprehensive Plan states,

"The city and County chose to plan for the high [population] projections, as they felt it best matched the high rates of growth being experienced within the county and would provide sufficient room for growth in the twenty-year planning period without artificially inflating development costs" (Chelan County, 2016, p. 17). The County is not planning on the population decreasing or remaining the same. The idea of the plan is to manage growth within the county. Planning only for growth leaves the community vulnerable if the population decreases and property maintenance is ignored. In contrast, the asset-based community readiness planning approach described in this paper focused community members' attention on four distinct possible futures, two of which did not involve growth. As a result, the participants generated strategies that were more robust than those envisioned in the Comprehensive Plan. Contingent strategies were also devised in case a particular future was realized.

In addition to addressing certain uncertainties in the Comprehensive Plan, the asset-based community readiness approach also provides a method for making the County Hazard Mitigation Plan more locally meaningful. The County's Multi-Jurisdiction Natural Hazard Mitigation Plan (Chelan County Emergency Management Council, 2011) is not localized to the level of Plain itself, in terms of spatial specificity or other conditions unique to the community such as social relations. The mapping of four distinct future scenarios for Plain, however, added local nuance to the spatial location and extent of the hazards the county plan addresses, which is essential information for strategies to identify and maintain fire and flood safety zones, designate evacuation routes, improve development codes, preserve forest health, and reduce the severity of fires and consequent floods. Less tangibly, but perhaps more importantly from a community readiness perspective, the act of generating stories about the community's identity, values, and assets may help mobilize local people to actively engage with one another, devise solutions on the multiple ways to survive and evolve, while gaining local and political support for the strategies this process generated.

Robust strategies common to multiple scenarios can help with setting investment and policy priorities, and contingent strategies can help planners anticipate differing futures. Both types of planning can be guided by community values and assets to ensure that plans are relevant to community interests and capacities to evolve overtime. Multiple strategies and plans in place can help communities and planners alike to adapt more rapidly in uncertain and changing times.

Acknowledgments

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Appendix A: Documents in the workshop

Worksheet #1: Reducing Risks (Exploiting Opportunities) Through Story Telling

Round 1				
STORY CONTEXT*		**PROBABLE EVEN TODAY**		**OBJECTIVES**
Your values	Things that provide what you value (capital):	HAZARD (CHANGE) 1. Location 2. Severity 3. Frequency 4. Timing	IMPACTS TO CAPITAL (+/-) 1. Natural 2. Built 3. Social	Reducing Risk / Exploiting Opportunities to: 1. Community 2. Forest 3. Floodplain
My community is great because:	Built: (houses, built systems…)	Notes:	Notes:	Community
	Natural (view, slope…)			Forest
It would be even better if:				
	Social (networks, relationships..)			Floodplain
Instructions: Circle most important.		Instructions: Feel free to make notes in columns (unique circumstances)		Instructions: Circle most important.

Worksheet #2

Round 2: in Black ink (Storytelling) Round 3: Red ink (FINALE)							
Scenario Event: _____		New Normal		Objectives Revisited	Risk Reduction / Opportunity Enhancement		
HAZARD (Change): 1. Location 2. Severity 3. Frequency 4. Timing	IMPACTS to capital: 1. Natural 2. Built 3. Social	Providers of Goods and Services: After a disaster what things (capital) are available to provide the goods and services you value?	New Normal: How has your community's daily life changed?	Reducing Risk / Exploiting Opportunities to: 1. Community 2. Forest 3. Floodplain	Approaches and Tools: Knowing what you now know, how would you improve your community? What would you do? Protect Adapt / Accommodate Relocate – Move to a safe place	Responsibility: Who should be responsible for implementation? 1. Family 2. Neighborhood 3. State 4. County 5. Non-Profit (Church, YMCS, Red Cross) 6. Other	Parking lot / Questions
		Built (houses, built systems…)					
		Natural (view, slope…)					
		Social (networks, relationships…)					
Instructions: Feel free to make notes in columns (unique circumstances)		Instructions: 1. Circle the most important (top three) 2. Feel free to draw lines.		Instructions: 1. Round 1: use black ink 2. round 2: use red ink 3. Circle the most important (rank major items if appropriate – top three) 4. Feel free to draw lines.			

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Chapter 3: Mainstreaming disaster preparedness

Abstract

The standard practice of measuring disaster preparedness in the United States is to measure disaster preparedness as an individual household attribute based on amounts of stocked supplies, hazard mitigation actions, and emergency planning (FEMA, 2014). This study assesses how day-to-day resources, specifically food, water, and social capital could influence disaster preparedness across different communities. The study used data from a mail survey sent to a random sample of Seattle households (N=1,342) stratified by zip codes selected for their contrasting demographic characteristics called South Seattle (ethnically diverse, low-income, less formally educated) and Other Seattle (predominantly white, middle- to high-income, more formally educated). Measurements of social capital (bonding and bridging) were associated with increased preparedness. This suggests that those with greater social capital are likely to be more prepared before and during disasters. Other Seattle reported more bridging social capital (connections with individuals who are not like them with respect to socioeconomic or other characteristics) than South Seattle, meaning they are likely to have more connections available to support them in response and recovery. Accounting for shared resources was induced in half of the surveys (randomly assigned to half of each sample by zip code) by framing the preparedness questions with "Consider how you and your family, friends, and neighbors might share." Accounting for shared resources increased reported preparedness levels beyond asking for reports of resources available to individual households.

1. Introduction

Education and outreach for disaster preparedness often focus on extreme events, whether natural or man-made, that occur seasonally at most (Ready Campaign, 2021). Preparing for extreme events can be a cognitive leap for some people. Instead, emergency managers can start with everyday life hazards. For example, before babies begin to crawl, new parents are encouraged to anchor furniture and televisions to walls, lock cabinets, purchase first aid kits, and establish a network of people who they can rely on in case of a childcare emergency and many more prevention and mitigation actions to protect their family. These protective behaviors are appropriate for mitigating day-to-day emergencies as well as seasonal and episodic disasters, but preparations for different types of disasters are often divorced from each other. Connecting preparedness for everyday hazards with more hazardous events might be more effective in encouraging people to be prepared for any kind of disaster. This study explores the availability of latent everyday resources and how they can be used for a disaster.

The standard practice of measuring disaster preparedness in the United States is to measure disaster preparedness as an individual household attribute based on amounts of stocked supplies, hazard mitigation actions, and emergency planning (FEMA, 2014). Nationally, the

message is for people to have at least three days of supplies for evacuation, or two weeks of supplies until normal operations of society can resume (American Red Cross, 2021). Recently the City of Seattle and the State of Washington changed their preparedness expectations to seven to ten days and two weeks, respectively (Pittman, 2017; Seattle Office of Emergency Management, n.d.). Preparedness is based on taking the appropriate actions in advance of a disaster. People who have not taken those appropriate actions are considered not prepared, or less prepared to respond at any given time. However, such measurements rarely if ever explicitly account for "the dual-use concept that highlights things people already have and use every day but can be critical to disaster response (American Red Cross & Federal Emergency Management Agency, 2013, p. 15)."

After the magnitude 6.4 earthquake in Puerto Rico on January 7, 2020, local community members consolidated food and cooked free meals for the community for days (DavidBegnaud, 2020). History is replete with examples of people helping each other out post-disaster and, in some cases, people help people they do know (R. Dynes, 2006). Russell Dynes argues that "[w]hile we calculate damage to physical and human capital, we usually ignore the social capital available within communities to deal with emergencies. Social capital is our most significant resource in responding to damage caused by natural and other hazards, such as terrorism" (2006, p. 2). Social capital and social networks can provide resources for response and recovery efforts. Resilience research and disaster management practices have yet to fully embrace this critical resource (Aldrich & Meyer, 2015), although there are a few notable disaster frameworks that do include these factors (Cutter, Burton, & Emrich, 2010; Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008).

This study examines assets that are available on a day-to-day basis—specifically food, water, and social capital—to ask two questions. First, do measures of earthquake preparedness that take into account shared (community) resources suggest that people and communities in Seattle are more prepared for an earthquake than do measures that only take into account individual household resources and capacities? Second, do measures of social capital predict disaster preparedness? The study uses a survey experiment to test differences between individual and shared resources which is called individual disaster preparedness (IDP) and community disaster preparedness (CDP), respectively. Taking these factors into account, the study explores how much estimates of preparedness might change if respondents were to take into account everyday supplies and social capital.

1.1 Background

Disaster preparedness

The household emergency earthquake preparedness measurement tool was first developed by Turner, Nigg, and Heller-Paz (1986). This was a methodological advancement because it provided a checklist of standardized inventories and actions of household preparedness that allowed researchers to compare across households (K. J. Tierney, Lindell, & Perry, 2001).

Russell, Goltz, and Bourque (1995) adapted the checklist to examine preparedness and mitigation before and after the 1986 Whittier Narrows and 1989 Loma Prieta earthquakes. In their words, "Conceptually, the preparedness questions appeared to be measuring three dimensions of preparedness: (a) survival – collecting and maintaining supplies and learning techniques such as first aid for basic survival; (b) planning – activities that reflect cognitive preparation and resource allocation, such as family instruction and purchasing earthquake insurance, respectively; and (c) hazard mitigation – securing and reinforcing a home and its contents (1995, p. 753)."

In 2003, under Homeland Security Presidential Directive/HSPD-8, the Federal Emergency Management Agency (FEMA) established Ready.gov, the federal government's clearinghouse for disaster preparedness information. The four categories of personal preparedness are: "(1) stay informed about the different types of emergencies that could occur and their appropriate responses, (2) make a family emergency plan, (3) build an emergency supply kit, and (4) get involved in your community by taking action to prepare for emergencies (Ready.gov, 2021)." In addition, FEMA strongly advises individuals to protect homes from natural hazards (FEMA, 2014). These categories are conceptually consistent with Turner, Nigg, and Heller-Paz's earthquake preparedness measurements. Survival activities suggested by FEMA include stockpiling supplies in case of an emergency; learning about how to be prepared; planning activities including family and community preparedness; and hazard mitigation activities that depend on hazard exposure.

The disaster preparedness framework is based on a needs-driven planning process that identifies local hazards, determines what is needed to mitigate the hazard, and works towards addressing those needs. Researchers consistently find that the most prepared people have average-to-high incomes, own a single-family home, and are White, English speaking, and highly educated (FEMA, 2014). Efforts to increase preparedness are focused on messaging, education, localizing risk, and tailoring preparedness behaviors based on types of hazards (American Red Cross & Federal Emergency Management Agency, 2013).

Preparedness measures focus on natural and man-made hazard events and not everyday hazards such as furniture tip-over hazards. For instance, FEMA surveys ask respondents about supplies "set aside" for disasters and "disaster supplies" in the home (FEMA, 2014, p. 63). Planning, training, exercise, and reliance questions with households, communities, and institutions follow the same pattern of focusing solely on actions or relationships related to disasters. These questions provide important information for understanding what people have done to explicitly prepare for disasters, but the questions do not ask about everyday resources that can be available for every day, as well as for extreme events as defined in hazards research. The omission is especially problematic for socio-economically vulnerable groups who may not have disposable income to stockpile supplies or space to store extra supplies (Eisenman, Glik, Maranon, Gonzales, & Asch, 2009).

Social vulnerability

There is ample evidence that marginalized groups are more socially vulnerable before, during, and after disasters than are predominately white, high-income, and formally educated communities (Blaikie, Cannon, Davis, & Wisner, 1994; Howell & Elliott, 2019; K. Tierney, 2014). Social vulnerability research to date focuses on historical and current social, physical, and economic processes that distribute resources unevenly across different groups, creating groups of people and places vulnerable to disasters (Blaikie et al., 1994; Fordham, Thomas, Phillips, & Lovekamp, 2013; Oliver-Smith & Goldman, 1988). Inequality is exacerbated after a disaster (Howell & Elliott, 2019). Social vulnerability research recognizes structural barriers to hazards resilience. Nevertheless, it often fails to center community knowledge, recognize and name intersectional oppressions, or encourage community activism, all key components for meaningful change (Jacobs, 2019). While some groups do face structural barriers to resilience, it is important to remember and recognize that they also have capacities to address disasters.

Levee failures from Hurricane Katrina led to the flooding of a low-income Vietnamese community in eastern New Orleans, with one-third of the community's population being evacuated or dislocated (Vu, VanLandingham, Do, & Bankston III, 2009). Vietnamese activists successfully worked to maintain social bonds during evacuation and recovery, contributing to a faster recovery than other communities in New Orleans with similar damage (Aldrich, 2012a; Li, 2011). Social capital was a latent resource that the Vietnamese community used to respond and recover from the hurricane and other cascading disasters. "Other communities similarly lacking in socio-economic resources also lack the social ties that would enable a more efficient and coordinated recovery – and this has dampened their resilience (Aldrich, 2012a, p. 131)."

This study examined the role of social capital in disaster preparedness and explored the relationship between social capital and racial and ethnic groups. In the United States, race and ethnicity are strongly correlated to social class; people with middle to high incomes are predominately white and people with low incomes are disproportionately non-white groups. Furthermore, minority groups differ from one another as well as from the white communities (K. Tierney, 2014). In addition, race and ethnic groups are not static categories but vary over space and time, due to political-historical processes (Bolin & Kurtz, 2018).

Towards an asset-based community readiness approach

Conventional needs-based approaches to solving community problems promote reliance on outside organizations for services and tend to reinforce feelings of dependency, inefficacy, and deficiency by low-income communities (Kretzmann & McKnight, 1993), as is evident from qualitative studies from South Africa (Nel, 2018). Asset-based community development (ABCD), as an alternative approach, instead focuses on the capacities, skills, and assets of the community (Kretzmann & McKnight, 1993). The approach seeks to identify and mobilize existing social and physical assets for community economic development. Social assets include the gifts, skills, and capacity of individuals to build and maintain relationships with each other and associations to solve community-identified problems. Collectively, these community builders map underutilized physical assets that can be repurposed for positive community

change and enlist local institutions in the development process. Kretzmann and McKnight (1993) argue that the key to neighborhood regeneration is connecting assets to each other to multiply power and effectiveness. In terms of being ready to handle any kind of emergency or disaster, an asset-based approach would first begin by assessing physical and social assets available for daily use and then consider how these assets could be repurposed for emergency purposes based on hazard exposure. If there are asset gaps, individuals and associations can work with institutions to address them to achieve hazard resilience.

Central to the ABCD approach is social relationships. Informal and formal relationships, associations, and networks are treated as both assets and a mechanism for mobilizing other community assets (Mathie & Cunningham, 2003). If we consider social relationships as assets, "ABCD is a practical application of the concept of social capital" (2003, p. 479). While scholars debate the concept of social capital, the general agreement in the literature is that social capital involves three aspects: trust (doing something for others with no expectation for immediate returns), norms (informal laws that govern daily life), and networks (individual relationships) (Aldrich, 2012a). Social capital in this sense "can improve the efficiency of society by facilitating coordination actions" (Putnam, Leonardi, & Nanetti, 1994, p. 167). As such, social capital can be an asset for disaster response and recovery (Aldrich, 2012b, 2012a; Aldrich & Meyer, 2015; R. Dynes, 2006; R. R. Dynes, 2002).

Some scholars have divided social capital into bonding, bridging, and linking (Aldrich, 2012a; Putnam, 2000; Szreter & Woolcock, 2004). Bonding social capital can be described as a network of individuals like oneself who have similar demographic characteristics, such as race and ethnicity, income level, and or religious affiliation. These relations can be "family members, close friends, and neighbors" (Woolcock, 2002, p. 26). Bonding social capital is good for "undergirding specific reciprocity and mobilizing solidarity" (Putnam, 2000, p. 22). Bridging social capital is good for connecting to external assets and spreading information. Bridging social capital links members of a group or network that differ by social identity but have the same shared interests (such as politics, environment, or profession). Bridging connections allow people to tap into different resources they do not normally have access to in bonding networks. Linking social capital refers to trusting relationships between people interacting within and across institutions with different levels of power and resources (Szreter & Woolcock, 2004). Connections with people in positions of power can greatly influence the type and amount of resources that are distributed across communities.

It is important to consider the quality and quantity of resources that people in networks can use and access because resources available to networks will differ across class groupings (Lin, 2000). People with low incomes tend to have bonding social capital only, whereas people with higher incomes have both bonding and bridging social capital but prefer to "preserve their social distance from most others, apart from the equally wealthy" (Szreter, 2002, p. 578). Connecting networks across income levels are rare. Bonding social capital helps people 'get by' whereas bridging social capital helps people 'get ahead' (de Souza Briggs, 1998). For example,

parents who depend on family or neighbors for childcare are people who use their networks to get by. They rely on bonding social capital to support them regularly. People who use personal connections to get a job and can hence, get ahead in life (de Souza Briggs, 1998). Bonding relationships can help people survive while bridging and linking relationships can help people recover post-disaster (Hawkins & Maurer, 2010). This study examined how bonding and bridging social capital could influence disaster preparedness and how they might differ across communities.

1.2 Research aims, questions, and hypotheses

The broader research aims of this study are to inform disaster preparedness campaigns on how asset-based approaches to readiness can improve people's agency to respond to seasonal and episodic hazardous events.

The specific research questions for this study are:

- Do assessments of individual household resources and capacities underestimate disaster preparedness, particularly by neglecting shared (community) resources?
- What, if any, types of social capital are associated with increases disaster preparedness?

The study examined four measurements of preparedness (Table 1) to evaluate potential underestimates of preparedness and to understand what influences preparedness. The first measure is 'preparedness counts' which is a total of disaster preparedness items a respondent reports having from a list of seven options. The second measure, 'preparedness counts weighted' is a total of disaster preparedness items weighted based on relative cost. These two measures account for supplies deliberately set aside for a disaster. The third and fourth measures are the number of days' worth of 'food' and 'water' survey participants estimate that they have. The first hypothesis was that estimates of preparedness are greater among people who are asked to report sharing preparation items with family and friends (community disaster preparedness, CDP), rather than just account for individual household preparations (individual disaster preparedness, IDP). To assess this, two versions of the survey were developed (CDP and IDP) with these different framings, described in detail in methods.

The study also examined the types of relationships different communities report. Previous research suggests that all groups have bonding relationships (de Souza Briggs, 1998); therefore the second hypothesis was that there are no differences in bonding relationships by community type because researchers. The third hypothesis was that there will be differences in bridging relationships by community type, wherein less privileged communities (South Seattle, more diverse neighborhoods, less formally education, and lower-income) have less bridging social capital than more privileged communities (Other Seattle, predominantly white neighborhoods, more educated, and higher income).

Earthquake experience, social capital, and demographic and socioeconomic factors were expected to influence disaster preparedness. People with earthquake experience might be

more prepared than people with no experience (Dunn, Ahn, Bostrom, & Vidale, 2016). Income and wealth can also influence preparedness levels because people with money can afford to stockpile supplies. Past studies have found that people living in single-family housing are more likely to be prepared (FEMA, 2014) because those living in multi-family housing have little room to store supplies (David P. Eisenman, Deborah Glik, Richard Maranon, Lupe Gonzales, & Steven Asch, 2009).

As people age, they may earn more money and gain more knowledge about safeguarding against hazards. Gender often plays a role in preparedness levels as well. Both men and women have different types of social relationships, which give them access to different resources (Lin, 2000). Males tend to have higher levels of preparedness than females and other genders (Fordham et al., 2013). For these reasons, earthquake experience, income, housing type, age, and gender are control variables. Perceived fairness and reciprocity are measures of trust and have been found to foster collaboration in recovery from disasters (Aldrich, 2012b). Perceived fairness and reciprocity were included in the model to assess their effects. Social relationships, sharing of resources (CDP, as compared to IDP), type of community (South vs Other Seattle), neighborhood tenure, and race and origin are expected to influence preparedness. Specifically, expectation is to see higher preparedness levels for those with more bonding and bridging relationships, higher preparedness for sharing (CDP) as compared to individual (IDP) reports, higher for those with longer neighborhood tenure, and higher for males, those in single-family homes, and those with earthquake experience. The study tested the interaction between bonding and community type and posited that there will be no significant difference. Similarly, the study tested the interaction between bridging and community type but this time and posited that levels of preparedness will positively be influenced in Other Seattle for those reporting bridging relationships because more privileged communities have more bridging social capital than less privileged communities. The study expects CDP, Other Seattle, and neighborhood tenure to positively influence preparedness. Finally, the study expects mixed results on race and origin.

2. Methodology

2.1.1 Survey

Our survey design was informed by prior research on disaster preparedness and social capital (Akbar & Aldrich, 2017; Dunn et al., 2016; FEMA, 2014; Reininger et al., 2013; Turner et al., 1986). A total of 18 questions were developed to measure earthquake experience, disaster preparedness, social capital, housing tenure, hazard awareness, demographics, and reliance on post-disaster assistance. To test whether CDP is greater than IDP, two surveys were developed with different disaster preparedness questions (Table 1); all the other questions were identical.

2.1.2 Sample

The paper mail survey was sent to a random sample of 4,600 Seattle households stratified by zip codes selected for their contrasting demographics (Figure 1). Zipcodes in South Seattle (SS) were more ethnically diverse and lower socioeconomic status than zip codes in Other Seattle (OS). In each stratified sample, participants were randomly assigned either an IDP or CDP survey.

Twenty-eight hundred surveys were sent to South Seattle and 1,800 surveys were sent to Other Seattle. More surveys were sent to South Seattle to represent racial and ethnic variability. Oversampling of small subpopulations is commonly done to make sure the resulting sample is large enough to analyze. Each envelope contained a letter explaining the study, a survey, a pre-paid return envelope, and a two-dollar bill (pre-commitment) incentive. Two reminder postcards were also mailed.

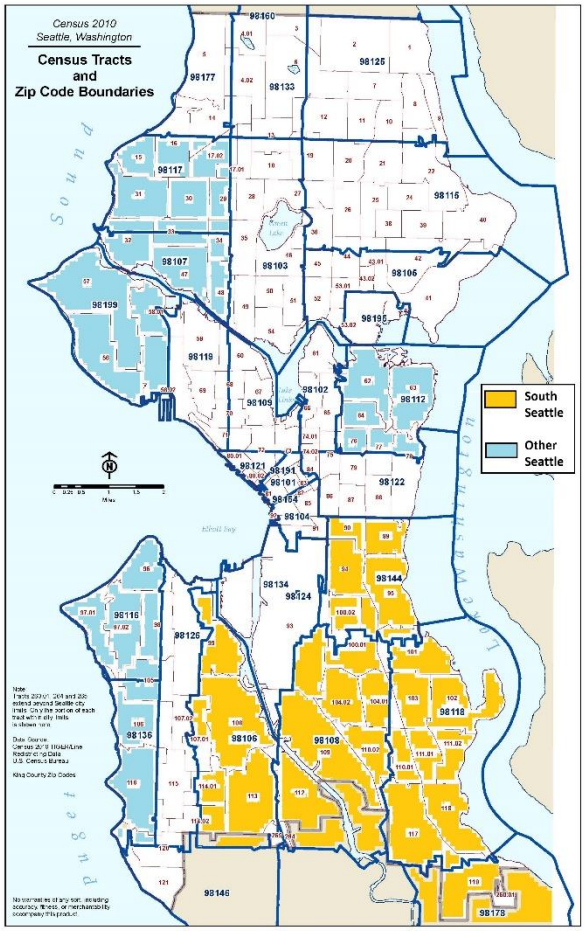

Figure 1. Map of the study area.
Source: City of Seattle Office of Labor Standards

2.2 Measures

2.2.1 Dependent variables

Four dependent variables were tested in the study: preparedness count, preparedness count weighted, food, and water (Table 1). For preparedness count and preparedness count weighted, the survey asked respondents who received the IDP survey, 'Which of these preparations for a disaster do you have? *(Check all that apply)*'. The respondents who received the CDP survey were asked, 'Which of these preparations for a disaster do you have, or could you rely on friends, family, and neighbors for? *(Check all that apply).*' The options were: *flashlight with batteries or solar*; *radio with batteries or solar*; *first aid kit*; *emergency plan*; *secured heavy furniture to the walls*; *supply of water and non-perishable food*; and *none of the above*. For food preparedness, the survey asked respondents who received the IDP survey, 'How many days' worth of food do you have at home? *(Select one).'* The respondents who received the CDP survey were asked, 'Consider how you and your family, friends, and neighbors might share. About how many days' worth of food

do you have available, altogether? *(Select one)'.* The options were *None, 1-3 days, 4-6 days, 1-2 weeks, 3-4 weeks,* or *More than 4 weeks*. For water, the survey used the same question and response options for food the word 'food' and was replaced with 'water' in the question.

The dependent variables in our analyses are measures of preparedness. For preparedness count, response options were coded as zero (unselected) and one (selected). Excluding *'None of the above'*, the responses were added up to create counts for each respondent. For preparedness count weighted, each item was weighted based on relative costs. A supply of water and non-perishable foods costs significantly more than a flashlight, radio, or first aid kit. Having an emergency plan and securing furniture to the walls costs little if any money at all (California Earthquake Authority, 2021). As such, high-cost items were weighted higher than lower-cost items then added up the responses excluding 'None' to create a preparedness count weighted variable. Food and water preparedness were coded on an ordinal scale from zero to six, corresponding to the rank order of the number of days' worth of supplies (Table 1).

2.2.2 Control variables

The survey contains built-in controls for several factors that may influence people's expected preparedness. Prior research has found that people with earthquake experience are more likely to be prepared than people who have no experience (Becker et al., 2012; Becker, Paton, Johnston, Ronan, & McClure, 2017; Dunn et al., 2016), as such, earthquake experience was a control variable. The survey asked respondents if they have personal experience in an earthquake. The response options were *'no'* (0)*, 'yes'* (1)*, and 'not sure'* (2). Earthquake experience was transformed into a binary variable for regression analysis, with yes in one category and no and not sure in the other. To encourage recollection of their earthquake experiences (excluded from these analyses), the survey asked additional questions of respondents who reported having earthquake experience. Respondents were asked an open-ended question about where and when they experienced their most memorable earthquake and the strength of the shaking they felt (see Appendices E and F). The amount of money a person has can influence their ability to purchase supplies and engage in other mitigation actions. Total household income before taxes categories ranged from '*Less than $25,000'* to *'$200,000 or more'*. There were eight categories altogether (see Appendices B and C) Household income was measured as an ordinal variable, with eight response categories ranging from *'Less than $25,000'* to *'$200,000 or more'*. Responses were coded from 0-7. The survey also had a question about what type of building people lived in. Housing type was a categorical variable with response options including: *'Single-fa* (1), *'Multi-family'* (2), *Other (specify)* (3), and *'Don't know* (4). This was transformed into a binary variable for regression analysis, in which living in a single-family home was coded as one and other categories were collapsed and coded as zero.

Table 1

Dependent variables for preparedness

Dependent variables	**Survey type**	**Question**	**Response options (count scoring; weighted count scoring)**	**Code**
Preparedness count and preparedness count weighted	IDP	Which of these preparations for a disaster do you have? *(Check all that apply):*	Flashlight with batteries or solar (0, 1; 0, 2) Radio with batteries or solar (0, 1; 0, 2) First aid kit (0, 1; 0, 2) Emergency plan (0, 1; 0, 1) Secured heavy furniture to the walls (0, 1; 0, 1) Supply of water and non-perishable food (0, 1/; 0, 3) None of the above (0, 1; 0, 1) [excluded from counts] **Preparedness count** **Preparedness count weighted**	 **0-6** **0-11**
	CDP	Which of these preparations for a disaster do you have, or could you rely on friends, family, and neighbors for? *(Check all that apply)*		
Dependent variables	**Survey type**	**Question**	**Response options**	**Code**
Food	IDP	How many **days' worth of food** do you have at home? *(Select one)*	None 1-3 days 4-6 days 1-2 weeks 3-4 weeks More than 4 weeks	0 1 2 3 4 5
	CDP	Consider how you and your family, friends, and neighbors might share. About how many **days' worth of food** do you have available, altogether? *(Select one)*		
Water	IDP	How many **days' worth of water** do	None	0

		you have at home? *(Select one)*	1-3 days	1
			4-6 days	2
	CDP	Consider how you and your family, friends, and neighbors might share. About how many **days' worth of water** do you have available, altogether? *(Select one)*	1-2 weeks	3
			3-4 weeks	4
			More than 4 weeks	5

Several demographic data points were considered as control variables. Age can be a factor in preparedness on many levels. Younger people tend to have low incomes and lack information about hazards which become barriers to preparedness. Age was treated as a continuous variable. Older adults have declining incomes and less money to stock up on supplies or lack the physical capabilities to secure furniture to the wall. Using the respondent's birth month and year, age was calculated. All respondents were 18 years old or older. The survey asked respondents to self-identify their gender, options included male (0), female (1), and other (2). Gender was transformed into a binary variable for the regression analysis where '*other'* was recoded as one.

For perceived fairness, respondents were asked to identify which of two statements resonated more with them: '*most people would try to take advantage of you if they got the chance'* or *'most people would try to be fair*.' The responses were coded as not fair (0) or fair (1), respectively. For perceived reciprocity respondents were asked to identify which of these two statements resonated most with them: *'most of the time people try to be helpful'* or *'most of the time people are mostly just looking out for themselves'*. Responses were coded as reciprocal (1) or not reciprocal (0), respectively.

2.2.3 Predictor variables

For bonding and bridging variables, respondents were asked, 'In the past 12 months, were you a member or participant in a (*Check all that apply*)'. The response options were *cultural, educational or hobby organization; labor union; professional association; immigrant or ethnic association or club; sports or recreation organization; environment, conservation, or wildlife organization; religious-affiliated group; service club; political party or club; other (specify);* and *none* (see Appendices E and F). Following previous research, cultural, educational, or hobby organizations, labor unions, immigrant or ethnic associations or clubs, sports or recreation

organizations, and the religious-affiliated groups was classified as bonding social capital. Likewise, professional association, environment, conservation, or wildlife organization, service club, and political party or club was classified as bridging social capital (Kwon, Heflin, & Ruef, 2013; Paxton, 2007; Smiley, Howell, & Elliott, 2018). Eighty-eight '*other (specify)*' responses were reviewed and 63 responses were reclassified into bonding or bridging social capital categories. For example, one respondent reported being a member of the "Filipino community". This was recoded into the immigrant or ethnic association or club response option which is a bonding social capital category. The remaining 25 responses to the 'other (specify)' category were coded as 'none'. A summary variable called bonding counts was created by adding up all bonding responses for each respondent. The total number of bonding relationships was used for analysis. Bonding counts could range from 0-5. Summary bridging counts were calculated used the same method as bonding counts. Bridging counts could range from 0-4.

The survey measured the type of community respondents lived in. This variable indicates whether the respondent lives in a predominate minority community of South Seattle (SS) or predominantly white community of Other Seattle (OS) zip codes. Respondents living in Other Seattle zip codes were coded as 0 and South Seattle zip codes were coded as 1.

As noted above, the two types of surveys assigned (randomly within zip code) were individual disaster preparedness (IDP) or community disaster preparedness (CDP), coded as 0 and 1, respectively. Interactions between the social capital questions (bonding and bridging) and survey type were examined in the study.

For race and origin, the survey asked, 'What is your race or origin? '. The response categories included White, Black or African American, Native Hawaiian or Other Pacific Islander, American Indian or Alaska Native, Hispanic, Latino, or Spanish origin (specify), Asian (specify), and Other race or origin (specify). The Asian category was disaggregated using the information provided by the respondent. If there were more than 20 respondents self-identifying as something other than Asian, a new category was created. Those categories are Chinese, Filipino, Japanese, and Vietnamese. All other Asian origins remained in the Asian category. Other categories were examined for disaggregation but there was not enough information to meaningfully to do so. 'Some Other Race or Origin Alone' and "Two or More Races or Origin' categories were also created. Dummy variables were created for race and origin, with white as the reference category for the regression analysis.

As noted above, the study hypothesized that neighborhood tenure will predict preparedness because people will know their community better, have more time to establish relationships, and possibly live in their home longer, giving them more time to secure furniture to the walls and accumulate assets. The survey asked, "how long have you lived in your neighborhood?'. The three response categories were '0-2 years' (0), '3-5 years' (1), and 'More than 5 years' (2).

2.1.2 Data analysis

Chi-square tests were used to test whether the survey framing (IDP vs CDP) influenced reported preparedness. Independent sample t-tests were used to test whether community types (OS vs SS) were associated with patterns of social relationships (bonding and bridging). Multivariate linear regressions were conducted to investigate the influences of social capital and other variables of interest on measures of disaster preparedness. Survey responses were transformed for the multivariate linear regression analyses, as noted above. Multicollinearity was examined by calculating the variance inflation factor. Statistical analysis was conducted in SPSS version 27.

3.Results

3.1 Sample

The response rate was 29 percent overall, with 641 responses (IDP=311, CDP=330) out of 1,800 from Other Seattle zip codes (36% response rate) and 699 responses (IDP=353, CDP=346) out of 2,800 from South Seattle zip codes (25% response rate), for a total of 1340 responses.

The Other Seattle sample was more representative of the population of those zip codes than the South Seattle sample was of the South Seattle zip codes (Table 2). For example, the difference between the population and sample for the Other Seattle White Alone group was 4.8% (79.5% in the population, 84.3% in the sample) as compared to a difference of 23.4% for South Seattle (34.3% in the population, 57.7% in the sample). Minority races were underrepresented in both community types although the underrepresentation was smaller for Other Seattle than for South Seattle. Disaggregated Asian categories were not available at the zip code level on Social Explorer, for which reason aggregated Asian categories are presented in the table.

In Other Seattle respondents earning less than $25,000 are underrepresented in the sample (4.61%) as compared to the population (8.91%). All other categories of income are well represented. In South Seattle, respondents earning less than $25,000 are underrepresented in the sample (10.89%) as compared to the population (17.30%) whereas respondents earning more than $200,000 are overrepresented in the sample (15.58%) as compared to the population (10.66%). All other categories of income are well represented (Appendix D, Table 1, Income).

In Other Seattle, respondents ages 18-34 years are underrepresented in the sample (18.80%) as compared to the population (39.32%). Respondents ages 65+ are overrepresented in the sample (26.74%) as compared to the population (16.37%). The other categories of age were well represented. In South Seattle, age categories 18-34 and 35-54 were underrepresented in

Table 2
Race or Origin

	POPULATION				SAMPLE			
	OS		SS		OS		SS	
Race or Origin	**Count**	**Percent**	**Count**	**Percent**	**Count**	**Percent**	**Count**	**Percent**
American Indian and Alaska Native Alone	371	0.20%	945	0.60%	1	0.16%	1	0.15%
Asian Alone	10,627	6.80%	41,731	26.30%	38	6.03%	138	20.26%
Black or African American Alone	3,153	2.00%	32,312	20.40%	8	1.27%	62	9.10%
Hispanic or Latino	8,662	5.60%	16,010	10.10%	17	2.70%	29	4.26%
Native Hawaiian and Other Pacific Islander Alone	153	0.10%	1,297	0.80%	0	0.00%	5	0.73%
Some Other Race Alone	178	0.10%	670	0.40%	5	0.79%	11	1.62%
Two or More Races	8,811	5.70%	11,146	7.00%	30	4.76%	42	6.17%
White Alone	123,753	79.50%	54,423	34.30%	531	84.29%	393	57.71%
Total	155,708	100.00%	158,534	99.90%	630	100.00%	681	100.00%

Source: Social Explorer Tables: ACS 2019 (5-Year Estimates) (SE), ACS 2019 (5-Year Estimates), Social Explorer; U.S. Census Bureau

the sample (17.15) as compared to the population (32.14%). Age categories 34-54 and 65+ years were overrepresented in the sample (42.88% and 25.27% respectively) as compared to the population (36.24% and 16.88% respectively). Respondents in the 55-64 years category were well represented. Overall, both samples skew older than the population (Appendix D, Table 2, Age).

Gender was split between male (49%) and female (50.5%). A small percentage of respondents self-reported another gender (0.5%).

3.2 Summary statistics

3.2.1 Experience

The majority of respondents reported having experience with earthquakes (83.1%) while a small minority reported no (14.8%) experience, and some were not sure if they had (2.1%).

3.2.2 Neighborhood tenure and housing type

Most respondents had lived in their neighborhoods for more than five years (62.1%). Twenty-three percent of respondents had lived in their neighborhood for 0-2 years and 15.3% for 3-5 years. Most respondents reported living in a single-family home (71.4%). The remaining reported living in multi-family (27.3%) or Other (0.9%) housing types. Some respondents said that they did not know (0.4%).

3.2.3 Preparations

IDP and CDP survey respondents respectively reported (Figure 2) having a flashlight with batteries or solar (91.0% IDP; 90.8% CDP), first aid kit (76.6%; 76.9%), supply of water and non-perishable foods (62.4%; 62.5%), radio with batteries or solar (48.7%; 48.1%), emergency plan (24.7%; 23.3%), secured heavy furniture to walls (19.9%; 17.3%), or nothing on the list (6.4%; 4.3%).

On average IDP respondents report 3.23 total preparations per household as compared to 3.19 for CDP respondents (see Appendix A for breakdown by survey and community type). To test whether CDP was greater than IDP for preparation counts a Chi-square test and independent sample t-test were conducted. The results of the Chi-square test showed the percentage of respondents who had zero to six preparation items differed by survey type, X^2 (6, N=1331) = 12.426, p=.053 (Table 3), as expected. According to Figure 3, more IDP survey respondents (6.4%) reported having zero preparedness items than CDP survey respondents (4.3%). The percentage of CDP survey respondents who reported having one (9.2%), two (19.3%), and five (15.2%) preparedness items was more than the percentage of IDP survey respondents reporting the same numbers of preparations (6.5%, 15.6%, 13.5% respectively). The percentage of respondents who reported having four preparedness items was about the same in both surveys. The percentage of IDP survey respondents who reported having three (26.9%) or six (6.5%) as greater than the percentage of CDP respondents reporting those amounts (22.6% and 5.2% respectively). An independent sample t-test was conducted to compare preparation counts by IDP and CDP. The results show no significant difference in means for IDP (M= 3.28, SD= 1.521) and CDP (M= 3.19, SD= 1.495); t(1329)=-.487, p=.626 which was unexpected.

The weighted average for preparedness count overall was 6.62. To test whether CDP was greater than IDP for preparation counts weighted Chi-square tests and independent sample t-tests were conducted. The results of the Chi-square test showed the percentage of respondents who had zero to 11 preparation items weighted did not differ significantly by survey type. CDP was expected to be greater than IDP. An independent sample t-test was conducted to compare preparation counts weighted by IDP and CDP. The results show no significant difference in means for IDP (M= 6.64, SD= 3.020) and CDP (M= 2.957, SD= 2.957); t(1339)=-.267, p=.790 which was unexpected.

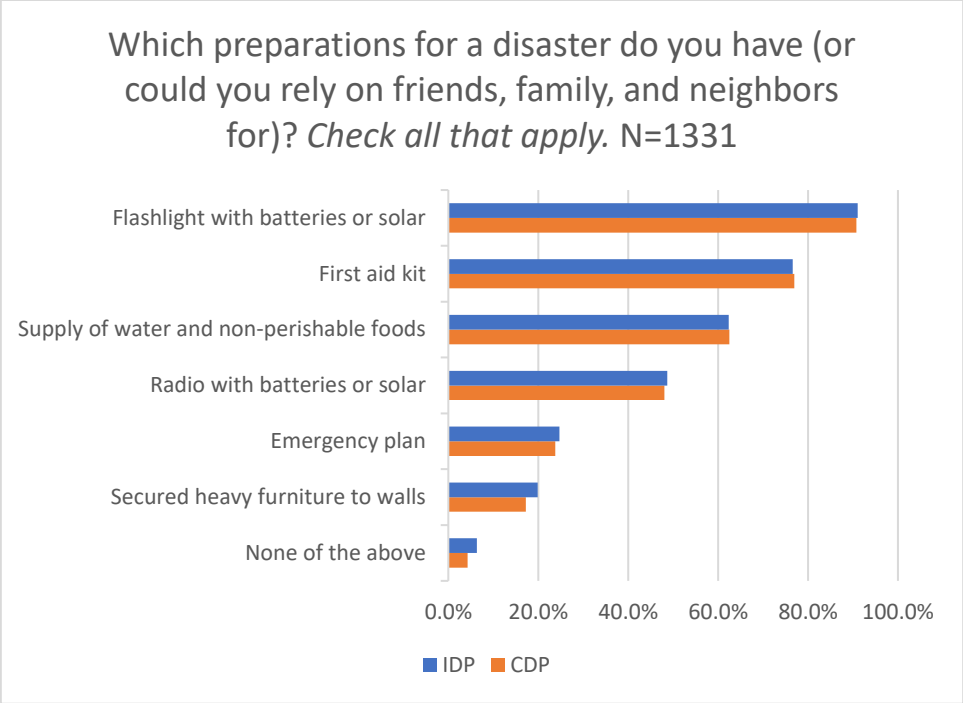

Figure 2. Preparations by IDP and CDP

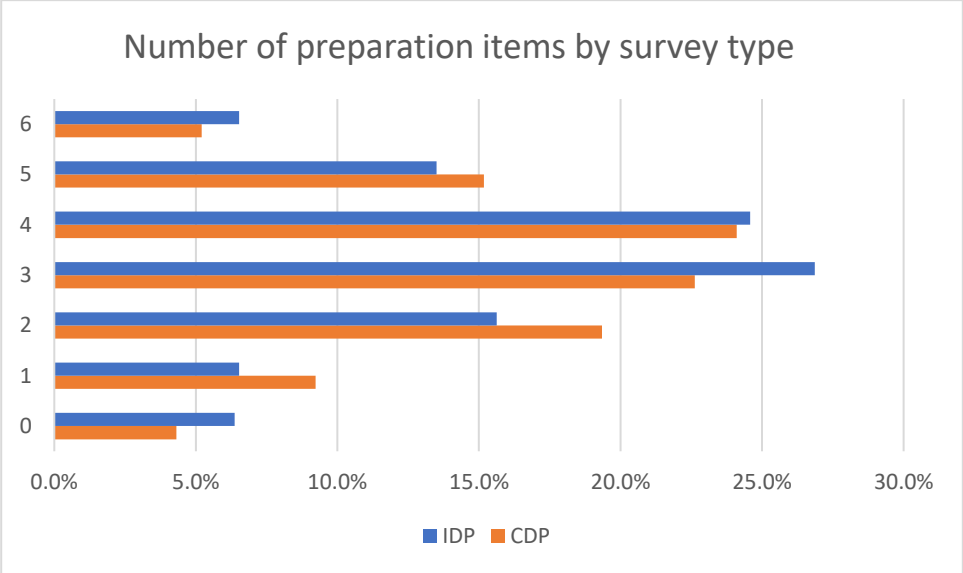

Figure 3. Number of preparations items by survey type

Table 3
Results of Chi-Square tests for preparation and community type.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12.426[a]	6	0.053
Likelihood Ratio	12.469	6	0.052
Linear-by-Linear Association	0.237	1	0.626
N of Valid Cases	1331		

3.1.4 Food and water

Respondents were asked two types of questions about food and water, as shown in Table 1. One question asks about a purposefully set-aside supply of food and water. As shown in Figure 2, roughly 62% of respondents in both IDP and CDP surveys reported having a supply of water and non-perishable foods, and roughly 38% report having nothing.

The other questions asked about the availability of food and water, which are more likely to elicit assessments of everyday supplies (Table 4). To test whether the distribution of CDP was greater than IDP for food a Chi-square test was conducted. The test showed that the differences between days' worth of food and survey type are marginally significant, $X^2(5, N=1333) = 10.958$, p=.052. There is no significant (p=.157) linear relationship between the two variables (Table 5). A little over one percent of respondents in the IDP survey report having zero days' worth of food as compared to 2.8% of respondents in the CDP survey. The percentage of CDP respondents was higher than IDP for the none, 1-3 days, 3-4 weeks, and More than 4 weeks response categories. The reverse was true for 4-6 days and 1-2 weeks. A small difference appeared between IDP and CDP at 4-6 days and the differences were greater at 1-2 weeks (see Table 4).

Independent sample t-tests were conducted for food by survey type (IDP and CDP) and community type (SS and OS). Using the lower limits of each category, the results revealed that in South Seattle, the mean is higher for IDP (M=6.5, SD=6.9) than CDP (M=5.4, SD 5.8); t(690)=2.396, p=.017), as unexpected. In Other Seattle, the mean is higher for CDP (M=6.3, SD=7.2) than IDP (M=5.0, SD=4.6); t(637)=-2.564, p=.011, as expected. Note that the response categories are not equal intervals, therefore the most conservative estimates were used.

More respondents in the IDP survey (13.0%) reported having no water as compared to respondents in the CDP survey (9.4%). Eighty percent of IDP and 90.6% of CDP respondents reported having one more than four weeks of water (Table 6). To test whether CDP was greater than IDP for water a Chi-square test was conducted. The Chi-square test revealed no statistical difference between IDP and CDP response distributions overall. Am independent sample t-test was conducted for water and community type. The results show no significant difference for water by survey and community type.

Table 4
Days' worth of food by community and survey type

(Consider how you and your family, friends, and neighbors might share.)
How many days' worth of food do you have at home (or have available, altogether)?

Food	OS IDP	OS CDP	SS IDP	SS CDP	IDP	CDP
	Frequency (N) / (%)	Frequency (N) / (%)	Frequency (N) / (%)	Frequency (N) / (%)	Frequency (N) / (%)	Frequency (N) / (%)
None	1 (0.3%)	6 (1.8%)	7 (2.0%)	13 (3.8%)	8 (1.2%)	19 (2.8%)
1-3 days	81 (26.1%)	96 (29.2%)	80 (22.9%)	92 (26.9%)	161 (24.4%)	188 (27.9%)
4-6 days	118 (38.1%)	111 (33.7%)	114 (32.6%)	116 (33.9%)	232 (35.2%)	228 (33.9%)
1-2 weeks	95 (30.6%)	74 (22.5%)	107 (30.6%)	94 (27.5%)	202 (30.6%)	168 (25.0%)
3-4 weeks	12 (3.9%)	27 (8.2%)	27 (7.7%)	20 (5.8%)	39 (5.9%)	47 (7.0%)
More than 4 weeks	3 (1.0%)	15 (4.6%)	15 (4.3%)	7 (2.0%)	18 (2.7%)	23 (3.4%)
Total	310	329	350	342	660	673

Table 5
Results of Chi-Square test for food and survey type

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.958[a]	5	0.052
Likelihood Ratio	11.099	5	0.049
Linear-by-Linear Association	1.998	1	0.157
N of Valid Cases	1333		

Table 6
Days' worth of water by community and survey type

(Consider how you and your family, friends, and neighbors might share.)
How many days' worth of water do you have at home (or have available, altogether)?

Water	OS IDP	OS CDP	SS IDP	SS CDP	IDP	CDP
	Frequency (N) / (%)	Frequency (N) / (%)	Frequency (N) / (%)	Frequency (N) / (%)	Frequency (N) / (%)	Frequency (N) / (%)
None	37 (11.9%)	31 (9.5%)	49 (14.0%)	32 (9.3%)	86 (13.0%)	63 (9.4%)
1-3 days	133 (42.8%)	142 (43.6%)	132 (37.6%)	142 (41.3%)	265 (40.0%)	284 (42.3%)
4-6 days	90 (28.9%)	86 (26.4%)	91 (25.9%)	94 (27.3%)	181 (27.3%)	181 (26.9%)
1-2 weeks	42 (13.5%)	51 (15.6%)	63 (17.9%)	54 (15.7%)	105 (15.9%)	106 (15.8%)
3-4 weeks	6 (1.9%)	9 (2.8%)	7 (2.0%)	14 (4.1%)	13 (2.0%)	23 (3.4%)
More than 4 weeks	3 (1.0%)	7 (2.1%)	9 (2.6%)	8 (2.3%)	12 (1.8%)	15 (2.2%)
Total	311	326	351	344	662	672

3.2.5 Perceived fairness and perceived reciprocity

Most respondents in Other Seattle and South Seattle reported that most people would try to be fair (83.7% and 75.6%, respectively) than would try to take advantage of them if they got the chance (16.3%; 24.4%). Similarly, most respondents in Other Seattle and South Seattle respectively reported that most of the time people would try to be helpful (80.2%; 71.2%) instead of people mostly just looking out for themselves (19.8%; 28.8%).

3.1.6 Bonding count by community type

An independent sample t-test was conducted to compare bonding counts in Other Seattle and South Seattle. The results show no significant difference in means for Other Seattle (M= .84, SD= .870) and South Seattle (M= .88, SD= .970); t(1311)=-.934, p=.351, as expected.

3.1.7 Bridging count by community type

An independent sample t-test was conducted to compare bridging counts in Other Seattle and South Seattle. There is a higher mean in Other Seattle (M= .83, SD= .931) than in South Seattle (M= .68, SD= .881); t(1311)= 3.029, p=.003, as expected.

3.2 Model results

The relationship between the four different dependent variables was examined (Table 1) by using cross-tabulation. There is a correlation between preparation count weighted and food. The results of the chi-square test showed that there is a relationship between preparedness count weighted and food, X^2 (55, N=1326) =266.994, p=.000. Finally, there is a correlation between preparedness count weighted and water as well. The results of the chi-square test showed that there is a relationship between preparedness count weighted and water, X^2 (55, N=1327) = 414.327, p=.000.

Multivariate linear regressions were ran using all dependent variables. The results revealed that preparedness count weighted had a higher adjusted R square (0.119) than food (0.040), and water (0.025). The differences between preparedness count weighted and preparedness count are small (see Appendix D for preparedness count model results). The results showed that the same variables were significant and in the standardized coefficients were similar although, preparedness count weighted had one more variable that came back significant (the coefficient on the race and ethnicity category “Japanese”). For reporting purposes, this paper focuses preparedness count weighted.[4] Standardized coefficients were reported and variables that are significant at the 5% and 10% levels are bolded.

[4] The variables for multicollinearity was checked and the results revealed that each variable had a variance inflation factor (VIF) of less than 2. A standard rule of thumb is that VIFs greater than 4 warrants more investigation and VIFs greater than 10 are signs of multicollinearity. Thus, multicollinearity is not an issue with variables in the model.

Table 4
Linear regression of preparedness count weighted

	Standardized Coefficients	
	Beta	**Sig.**
(Constant)		0.000
Bonding count	**0.068**	0.021
Bridging count	**0.104**	0.001
Perceived fairness	0.035	0.290
Perceived reciprocity	-0.033	0.319
CDP	0.016	0.558
South Seattle	-0.006	0.845
American Indian or Alaska Native	**-0.056**	0.042
Asian	-0.011	0.700
Black or African American	**-0.059**	0.042
Hispanic, Latino, or Spanish origin	-0.007	0.793
Native Hawaiian or Other Pacific Islander	-0.008	0.768
Some Other Race or Origin Alone	0.027	0.336
Two or More Races or Origin	-0.018	0.520
Chinese	-0.023	0.411
Filipino	0.004	0.886
Japanese	**0.048**	0.086
Vietnamese	**-0.047**	0.095
Neighborhood tenure	**0.108**	0.001
Single-family home	0.046	0.137
Earthquake experience	0.029	0.301
Age	**0.207**	0.000
Female or Some Other Gender	**-0.059**	0.038
Income	**0.100**	0.003

3.2.1 Social capital

Having close ties with family, friends, and neighbors contributes to increased preparedness levels. As expected, bonding and bridging relationships are positively associated with preparedness levels. However, the coefficients on perceived fairness and reciprocity are small and not significantly different from zero. Perceived fairness and reciprocity were expected to have significant positive coefficients.

3.2.2 Survey and community type

There was an expectation that shared resources (CDP) to be greater than individual resources (IDP) for disaster preparedness, but the results show no significant difference. There was an expectation that respondents in Other Seattle to be more prepared than in South Seattle however, the results show no significant difference between the two areas.

3.2.3 Demographic and socioeconomic variables

Because people with higher incomes have more money to prepare for disasters, income was a control variable and as expected, the coefficient for income is positive and significant in the model. Preparedness levels also increase with age as expected. The coefficient for female and other gender is negative as expected and is significantly different from males.

As expected, results vary across the eleven categories of race and origin in the model. American Indian and Native Alaskan, Black or African American and Vietnamese were significant in a negative direction compared to the reference category of White (i.e., less prepared). Japanese was significant in a positive direction compared to the reference category of White (i.e. more prepared). The other categories showed no differences from the reference category.

The coefficient for neighborhood tenure is positive and significant. Increased preparedness levels for people living in single-family homes as opposed to multi-family or other housing types was expected but although the coefficient is positive, there is no significant difference in preparedness by housing type, after controlling for other variables.

4. Discussion

When a disaster disrupts normal life, people may use whatever resources and capacities are available to them. For this reason, resources available to people on an everyday basis was studied as well as supplies deliberately set aside for extreme disasters as defined in hazards research. There is evidence to suggest that everyday resources such as food, water, and social capital could be available for disasters. Findings on social capital and implications for social capital emerge. First, in this study, there is evidence that bonding and bridging social capital differ across community types, as measured by Other Seattle and South Seattle. There is a marginal statistically significant difference in bonding by community type, as unexpected. No differences was the expected outcome. Other Seattle had slightly more bonding relationships than South Seattle. Other Seattle had more bridging social capital than South Seattle, as expected. Further, both were associated with preparedness, in the anticipated direction (more relationships are associated with greater preparedness). Interaction terms were created for bonding and bridging counts by community type and added to the model but results revealed that the variables were not statistically significant and highly correlated with bonding, bridging, and community type, for which reason they were removed from the final model. Secondly,

perceived fairness and reciprocity, both measures of trust were not significant in the model. The expectation was to see trust associated positively with preparedness.

There is some evidence that people expect to share resources post-disaster. Respondents in Other Seattle expect to share more food resources than not (CDP is greater than IDP). However, this does not seem to be true for respondents in South Seattle (CDP is less than IDP). By framing the CDP survey around resource sharing the expectation was that it would increase expected preparedness in both types of communities. People in South Seattle earn less income than those in Other Seattle and hence, respondents might think that their friends, family, and neighbors will rely on them for resources post-disaster therefore reducing the amount of food available. In terms of preparedness count, the results show that there is a difference in the distribution of the number of preparedness items respondents reported by survey type. Preparedness counts for CDP are greater than IDP at one, two, and five counts. Again, suggesting that sharing resources may result in greater preparedness.

For measures of food and water, there were differences between supplies deliberately set aside for disasters and supplies available on an everyday basis. Thirty-eight percent of people report having no supply of water and non-perishable food. In this measurement, the assumption is that respondents do not have these supplies for up to three days, a long-standing recommendation by all levels of government and emergency response agencies. When the food and water variables are compared, to results revealed that 28.2% of respondents report having no food (0-3 days) and 52.3% of respondents report having no water (0-3 days). The percentage difference between supplies set aside and everyday use is large and might suggest that there are more available resources for disasters. A caveat here is that survey methodology suggests that the check-all-that apply question format can generate underestimates because people may not read all the options (Dillman, Smyth, Christian, & Stern, 2003; Smyth, Dillman, Christian, & Stern, 2006). For supplies set aside for a disaster, 'water and non-perishable food' was listed as the second to last item which means respondents could have just skipped it.

In terms of neighborhood tenure, the results revealed that the longer people live in their neighborhood the more prepared they are for an earthquake. Living in the same neighborhood gives people time to establish relationships, gain knowledge about the risks and hazards, and take appropriate mitigation actions. Right now, South Seattle residents are at the highest risk of displacement, which means they are more vulnerable (Seattle Office of Planning & Community Development, 2016).

5. Conclusion

The results of this study reveal that social relations matter for disaster preparedness. Having strong ties with people that are like you (bonding) is important for all communities in our study (South and Other Seattle) and increases preparedness. Relationships with people and groups of with dissimilar socioeconomic demographics (bridging) also matter, however, and respondents

in Other Seattle report having more of these types of relationships than respondents in South Seattle. Bonding social capital can help people respond to disasters while bridging social capital can help people recover more quickly. Social relationships are a vital component to advancing an asset-based community readiness approach to disaster preparedness. Ordinary people have knowledge, skills, and capacities that can be mobilized for positive action. While linking social capital was not studied, future research could study how to link groups with different levels of power and resources for more equitable outcomes. Emergency managers and policymakers can find ways to foster relationships within and across groups for greater solidarity before disasters and, equally important, post-disaster.

There is evidence that measurements of preparedness deserve to be revisited by researchers. Weighted measurements of preparedness counts improved model results slightly. While the differences here are small, there is cause to revisit how researchers treat different preparedness supplies. As mentioned earlier, the cost of different items could mean that some items are hard to stockpile and should be weighted more than something cheaper to purchase. There is also evidence that survey framing (IDP vs. CDP) can change estimates of preparedness. In some of our analyses community disaster preparedness, CDP, is greater than individual disaster preparedness (IDP), as expected.

In preparing for disasters, it is important to first start by thinking of current physical and social assets that already exist and are used for everyday emergencies or hazards. Then think about how these resources can be used in extreme disasters and determine what else is needed to effectively respond and recover. This is called an asset-based community readiness approach to disaster preparedness.

An illustration of the potential opportunities for asset-based community readiness approaches comes from the application of this thinking in a community disaster preparedness training class that I hosted at an ethnic community meeting. I asked people to assess what kinds of food, water, and medical supplies people have in their homes. Then I asked them to write down on a white kitchen garbage bag what they could pack and use in an emergency where they would have to evacuate. An asset-based community readiness approach encourages participants to approach disaster preparedness in this way if they are unable to explicitly set aside supplies for disasters. One participant said, “This is so much more manageable and doable, especially when it comes to taking food, water, and supplies you already have in your home then stockpiling supplies for an event that may or may not happen in my lifetime. Also, I cannot afford to stockpile supplies, but I can assess what I have and plan to bring it with me if I need to.”

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Appendix A: Study area selection and sampling

Table 1:

Study area selection in Seattle, WA S based on ACS 2017 (5-year estimates) Census Data

Study area	Seattle ZCTA	Total Population	% White Alone	% Speak English Less than "Very Well"	% Bachelor's Degree +	Med HH Income	% Owner Occupied
South Seattle	98178	27279	0.286	0.205	0.276	72478	0.613
South Seattle	98108	24134	0.306	0.288	0.319	55314	0.546
South Seattle	98118	46800	0.33	0.227	0.381	62504	0.578
South Seattle	98144	30850	0.483	0.17	0.503	71628	0.472
South Seattle	98106	26244	0.487	0.15	0.368	62726	0.492
Not in study	98104	14143	0.515	0.173	0.407	37610	0.107
Not in study	98134	844	0.538	0.083	0.325	58125	0.304
Not in study	98146	27587	0.564	0.173	0.294	61160	0.599
Not in study	98121	16466	0.649	0.032	0.725	94813	0.205
Not in study	98133	48390	0.656	0.123	0.438	60409	0.475
Not in study	98122	37270	0.657	0.059	0.653	72018	0.334
Not in study	98105	47128	0.659	0.085	0.752	56015	0.352
Not in study	98125	40803	0.663	0.122	0.545	61014	0.472
Not in study	98126	23360	0.679	0.095	0.509	73698	0.57
Not in study	98101	12408	0.703	0.068	0.6	68750	0.188
Not in study	98109	27002	0.725	0.046	0.745	95719	0.293
Not in study	98102	24703	0.787	0.018	0.743	83403	0.291
Not in study	98115	51523	0.803	0.036	0.731	100794	0.625
Not in study	98119	25036	0.81	0.031	0.733	85171	0.416
Not in study	98177	20278	0.822	0.036	0.629	100036	0.775
Not in study	98103	51385	0.832	0.026	0.739	91740	0.474
Other Seattle	98136	16364	0.832	0.029	0.607	97673	0.673
Other Seattle	98107	24384	0.835	0.019	0.725	83581	0.384
Other Seattle	98199	21660	0.839	0.029	0.68	103309	0.646
Other Seattle	98112	24720	0.85	0.027	0.788	110051	0.548
Other Seattle	98116	25694	0.851	0.017	0.65	100711	0.593
Other Seattle	98117	33610	0.867	0.024	0.68	102519	0.722

Table 2. Sampling by Location

Study Area Zip Codes	Study Area	Majority	IDP or CDP		Responses desired	Final responses desired	Sample sizes
98106, 98108, 98118, 98144, 98178	South Seattle	Non White	IDP	100	175	700	2800
	South Seattle	Non White	CDP	100	175		
	South Seattle	White	IDP	100	175		
	South Seattle	White	CDP	100	175		
98107, 98112, 98116, 98117, 98136, 98199	Other Seattle	White	IDP	100	225	450	1800
	Other Seattle	White	CDP	100	225		
					Total	1150	4600

Table 3. Income

	POPULATION						SAMPLE					
	Other Seattle		South Seattle		Total	Percent	Other Seattle		South Seattle		Total	Percent
Less than $25,000	6352	8.91%	10495	17.30%	16847	12.77%	28	4.61%	72	10.89%	100	7.88%
$25,000 to $34,999	2660	3.73%	4663	7.69%	7323	5.55%	24	3.95%	45	6.81%	69	5.44%
$35,000 to $49,999	4853	6.80%	6417	10.58%	11270	8.54%	39	6.41%	50	7.56%	89	7.01%
$50,000 to $74,999	9096	12.75%	8807	14.52%	17903	13.57%	83	13.65%	102	15.43%	185	14.58%
$75,000 to $99,999	8184	11.48%	6752	11.13%	14936	11.32%	92	15.13%	93	14.07%	185	14.58%
$100,000 to $149,999	14626	20.51%	11303	18.64%	25929	19.65%	115	18.91%	121	18.31%	236	18.60%
$150,000 to $199,999	8462	11.87%	5749	9.48%	14211	10.77%	80	13.16%	75	11.35%	155	12.21%
$200,000 or more	17085	23.96%	6466	10.66%	23551	17.85%	147	24.18%	103	15.58%	250	19.70%
Total	71318	100.00%	60652	100.00%	131970	100.00%	608	100.00%	661	100.00%	1269	100.00%
Social Explorer Tables: ACS 2019 (5-Year Estimates) (SE), ACS 2019 (5-Year Estimates), Social Explorer; U.S. Census Bureau												

Table 4. Age

	POPULATION						SAMPLE					
	OS		SS		Study Area		OS		SS		Study Area	
Age	Count	Percent	Count	Percent	Count	Perecent	Count	Percent	Count	Percent	Count	Percent
18-34 Years	38,293	29.81%	40614	32.14%	78,907	30.96%	116	18.80%	112	17.15%	228	17.95%
35-54 Years	50,505	39.32%	45795	36.24%	96,300	37.79%	245	39.71%	280	42.88%	525	41.34%
55-64 Years	18,634	14.51%	18635	14.75%	37,269	14.62%	91	14.75%	96	14.70%	187	14.72%
65+ Years	21,029	16.37%	21327	16.88%	42,356	16.62%	165	26.74%	165	25.27%	330	25.98%
Total	128,461	100.00%	126371	100.00%	254,832	100.00%	617	100.00%	653	100.00%	1270	100.00%

Social Explorer Tables: ACS 2019 (5-Year Estimates) (SE), ACS 2019 (5-Year Estimates), Social Explorer; U.S. Census Bureau

Appendix B: Individual disaster preparedness survey in English

COMMUNITY PREPAREDNESS SURVEY

1. **Have you personally experienced an earthquake?** *(Select one)*

☐ Yes ☐ No [skip to question 2] ☐ Not sure [skip to question 2]

If Yes: 1a. **Where and when did you experience this earthquake** (your most memorable earthquake)?

Where: _____ When: _____

1b. **How strong was the shaking that you felt?** *(Select one)*

Not felt	Weak shaking (felt, but unsure was a quake)	Mild shaking (dishes, windows, doors shook)	Moderate shaking (dishes, windows broken)	Strong shaking (heavy furniture moved)	Violent shaking (great damage)	Not applicable
☐	☐	☐	☐	☐	☐	☐

2. **Which of these preparations for a disaster do you have**? *(Check all that apply)*

- ☐ Flashlight with batteries or solar
- ☐ Radio with batteries or solar
- ☐ First aid kit
- ☐ Emergency plan
- ☐ Secured heavy furniture to the walls
- ☐ Supply of water and non-perishable food
- ☐ None of the above

3. **How many days' worth of food do you have at home?** *(Select one)*

None	1-3 days	4-6 days	1-2 weeks	3-4 weeks	More than 4 weeks
☐	☐	☐	☐	☐	☐

4. **How many days' worth of water do you have at home?** *(Select one)*

None	1-3 days	4-6 days	1-2 weeks	3-4 weeks	More than 4 weeks
☐	☐	☐	☐	☐	☐

5. **Which of these statements resonates most with you?** *(Select one)*

- ☐ Most people would try to take advantage of you if they got the chance
- ☐ Most people would try to be fair

6. **Which of these statements resonates most with you?** *(Select one)*

- ☐ Most of the time people try to be helpful
- ☐ Most of the time people are mostly just looking out for themselves

7. **In the past 12 months, were you a member or participant in a** *(Check all that apply)*

- ☐ Cultural, educational or hobby organization
- ☐ Labor union
- ☐ Professional association
- ☐ Immigrant or ethnic association or club
- ☐ Sports or recreation organization
- ☐ Environment, conservation, or wildlife organization
- ☐ Religious-affiliated group
- ☐ Service club
- ☐ Political party or club
- ☐ Other (specify) _____
- ☐ None

8. **What is your home zip code?** Zip Code: _____

9. **How long have you lived in your neighborhood?**

0-2 years	3-5 years	More than 5 years
☐	☐	☐

10. **What type of building do you live in?**

- ☐ Single-family
- ☐ Multi-family
- ☐ Other (specify)_____
- ☐ Don't know

11. **Is your home in a location that is prone to:** *(Check all that apply)*

- ☐ Floods
- ☐ Earthquakes
- ☐ Landslides
- ☐ Liquefaction
- ☐ Tsunamis
- ☐ None of the above
- ☐ Don't know

12. **What is your race or origin?** *(Check all that apply)*

- ☐ White
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ American Indian or Alaska Native
- ☐ Hispanic, Latino, or Spanish origin (specify) _____
- ☐ Asian (specify) _____
- ☐ Other race or origin (specify)_____

13. **What is your gender?**

- ☐ Female
- ☐ Male
- ☐ Other

14. **What is your present religion, if any?**

☐ Protestant	☐ Orthodox (Greek or Russian)
☐ Roman Catholic	☐ Jewish
☐ Mormon	☐ Muslim
☐ Buddhist	☐ Hindu
☐ Atheist	☐ Other (specify)_____
☐ Agnostic	☐ None

15. **What language(s) do you speak at home?** *(Check all that apply)*

☐ English	☐ Somali
☐ Spanish	☐ Korean
☐ Chinese	☐ Russian
☐ Vietnamese	☐ Other (specify)_____

16. **What was your total household income before taxes during the past 12 months?**

- ☐ Less than $25,000
- ☐ $25,000 to $34,999
- ☐ $35,000 to $49,999
- ☐ $50,000 to $74,999
- ☐ $75,000 to $99,999
- ☐ $100,000 to $149,999
- ☐ $150,000 to $199,999
- ☐ $200,000 or more

17. **What is your birthday?** Month: _____ Year: _____

18. This extra question will help local government better understand how to improve community preparedness. **In the first 72 hours following a disaster, please indicate how much you would expect to rely on the following for assistance.** *Please use a scale of 1 to 5, with 5 being "expect to rely on a great deal" and 1 being "do not expect to rely on at all."*

	Do not expect to rely on at all 1	2	3	4	Expect to rely on a great deal 5
Household members	☐	☐	☐	☐	☐
People in my neighborhood	☐	☐	☐	☐	☐
Non-profit organizations, such as the American Red Cross or the Salvation Army	☐	☐	☐	☐	☐
My faith community, such as a congregation	☐	☐	☐	☐	☐
Fire, police, emergency personnel	☐	☐	☐	☐	☐
State and Federal Government agencies, including FEMA	☐	☐	☐	☐	☐

Thank you for completing the survey! Please return it in the enclosed pre-addressed postage-paid envelope.

We welcome any additional thoughts you might have about preparedness, on the front cover or by email to M9survey@uw.edu.

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Appendix C: Community disaster preparedness survey in English

COMMUNITY PREPAREDNESS SURVEY

1. **Have you personally experienced an earthquake?** *(Select one)*

☐ Yes ☐ No [skip to question 2] ☐ Not sure [skip to question 2]

If Yes: 1a. **Where and when did you experience this earthquake** (your most memorable earthquake)?

Where: _____ When: _____

1b. **How strong was the shaking that you felt?** *(Select one)*

Not felt	Weak shaking (felt, but unsure was a quake)	Mild shaking (dishes, windows, doors shook)	Moderate shaking (dishes, windows broken)	Strong shaking (heavy furniture moved)	Violent shaking (great damage)	Not applicable
☐	☐	☐	☐	☐	☐	☐

2. **Which of these preparations for a disaster do you have, or could you rely on friends, family and neighbors for?** *(Check all that apply)*

- ☐ Flashlight with batteries or solar
- ☐ Radio with batteries or solar
- ☐ First aid kit
- ☐ Emergency plan
- ☐ Secured heavy furniture to the walls
- ☐ Supply of water and non-perishable food
- ☐ None of the above

3. **Consider how you and your family, friends, and neighbors might share. About how many days' worth of food do you have available, altogether?** *(Select one)*

None	1-3 days	4-6 days	1-2 weeks	3-4 weeks	More than 4 weeks
☐	☐	☐	☐	☐	☐

4. **Consider how you and your family, friends, and neighbors might share. About how many days' worth of water do you have available, altogether?** *(Select one)*

None	1-3 days	4-6 days	1-2 weeks	3-4 weeks	More than 4 weeks
☐	☐	☐	☐	☐	☐

5. **Which of these statements resonates most with you?** *(Select one)*

- ☐ Most people would try to take advantage of you if they got the chance
- ☐ Most people would try to be fair

6. **Which of these statements resonates most with you?** *(Select one)*

- ☐ Most of the time people try to be helpful
- ☐ Most of the time people are mostly just looking out for themselves

7. **In the past 12 months, were you a member or participant in a** *(Check all that apply)*

- ☐ Cultural, educational or hobby organization
- ☐ Labor union
- ☐ Professional association
- ☐ Immigrant or ethnic association or club
- ☐ Sports or recreation organization
- ☐ Environment, conservation, or wildlife organization
- ☐ Religious-affiliated group
- ☐ Service club
- ☐ Political party or club
- ☐ Other (specify) _____
- ☐ None

8. **What is your home zip code?** Zip Code: _____

9. **How long have you lived in your neighborhood?**

0-2 years	3-5 years	More than 5 years
☐	☐	☐

10. **What type of building do you live in?**

- ☐ Single-family
- ☐ Multi-family
- ☐ Other (specify)_____
- ☐ Don't know

11. **Is your home in a location that is prone to:** *(Check all that apply)*

- ☐ Floods
- ☐ Earthquakes
- ☐ Landslides
- ☐ Liquefaction
- ☐ Tsunamis
- ☐ None of the above
- ☐ Don't know

12. **What is your race or origin?** *(Check all that apply)*

- ☐ White
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ American Indian or Alaska Native
- ☐ Hispanic, Latino, or Spanish origin (specify) _____
- ☐ Asian (specify) _____
- ☐ Other race or origin (specify)_____

13. **What is your gender?**

- ☐ Female
- ☐ Male
- ☐ Other

14. **What is your present religion, if any?**

☐ Protestant	☐ Orthodox (Greek or Russian)
☐ Roman Catholic	☐ Jewish
☐ Mormon	☐ Muslim
☐ Buddhist	☐ Hindu
☐ Atheist	☐ Other (specify)_____
☐ Agnostic	☐ None

15. **What language(s) do you speak at home?** *(Check all that apply)*

☐ English	☐ Somali
☐ Spanish	☐ Korean
☐ Chinese	☐ Russian
☐ Vietnamese	☐ Other (specify)_____

16. **What was your total household income before taxes during the past 12 months?**

- ☐ Less than $25,000
- ☐ $25,000 to $34,999
- ☐ $35,000 to $49,999
- ☐ $50,000 to $74,999
- ☐ $75,000 to $99,999
- ☐ $100,000 to $149,999
- ☐ $150,000 to $199,999
- ☐ $200,000 or more

17. **What is your birthday?** Month: _____ Year: _____

18. This extra question will help local government better understand how to improve community preparedness. **In the first 72 hours following a disaster, please indicate how much you would expect to rely on the following for assistance.** *Please use a scale of 1 to 5, with 5 being "expect to rely on a great deal" and 1 being "do not expect to rely on at all."*

	Do not expect to rely on at all				Expect to rely on a great deal
	1	2	3	4	5
Household members	☐	☐	☐	☐	☐
People in my neighborhood	☐	☐	☐	☐	☐
Non-profit organizations, such as the American Red Cross or the Salvation Army	☐	☐	☐	☐	☐
My faith community, such as a congregation	☐	☐	☐	☐	☐
Fire, police, emergency personnel	☐	☐	☐	☐	☐
State and Federal Government agencies, including FEMA	☐	☐	☐	☐	☐

Thank you for completing the survey! Please return it in the enclosed pre-addressed postage-paid envelope.

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Appendix D: Preparedness count model results

Table 1. Linear regression on preparedness count

	Standardized Coefficients Beta	Sig.
(Constant)		0.000
Bonding count	**0.068**	0.020
Bridging count	**0.114**	0.000
Perceived fairness	0.040	0.221
Perceived reciprocity	-0.038	0.259
CDP	0.016	0.574
South Seattle	0.009	0.773
American Indian or Alaska Native	**-0.053**	0.056
Asian	-0.019	0.498
Black or African American	**-0.067**	0.021
Hispanic, Latino, or Spanish origin	-0.024	0.406
Native Hawaiian or Other Pacific Islander	-0.006	0.817
Some Other Race or Origin Alone	0.027	0.325
Two or More Races or Origin	-0.001	0.958
Chinese	-0.026	0.361
Filipino	0.007	0.807
Japanese	0.046	0.103
Vietnamese	**-0.047**	0.096
Neighborhood tenure	**0.109**	0.001
Single-family home	0.048	0.119
Earthquake experience	0.022	0.447
Age	**0.194**	0.000
Female or Some Other Gender	**-0.061**	0.031
Income	**0.096**	0.004

Chapter 4: Fairness and social trust: Whom do people turn to for help following a disaster?

Abstract

Available resources vary in quantity and quality across different communities in large part due to historical processes that advantage, and disadvantage, different groups based on race, sex, gender, and other characteristics. A ramification of systematic inequality may be warranted lack of trust and low perceptions of fairness in historically disadvantaged communities. Feelings of fairness and general reciprocity (trust) can impact who people expect to rely on post-disaster assistance. This study measures perceived fairness and trust across community types, and examines how perceived fairness, general reciprocity, and preparedness influence expected reliance on local informal (household members and people in the neighborhood) and formal professional (fire, police, and emergency personnel) response groups. The study used data from a mail survey sent to a random sample of Seattle households (N=1,342) stratified by zip codes selected for their contrasting demographic characteristics, called South Seattle (ethnically diverse, low-income, less formally educated) and Other Seattle (predominantly white, middle- to high-income, more formally educated). Respondents in South Seattle reported less perceived fairness and less trust than respondents in Other Seattle. General reciprocity was positively associated with reliance on both informal and formal response and recovery support groups, after controlling for other influences. Also, increased preparedness was associated with more reliance on household members and people in the neighborhood, and less expected reliance on fire, police, and emergency personnel, all else equal.

1. Introduction

Disasters are a result of the interaction of hazards and vulnerable populations (Blaikie et al., 1994; Mileti, 1999; Wisner et al., 2004). A significant threat along the coast of the Pacific Northwest is the Cascadia subduction zone (CSZ). The CSZ can generate a magnitude 9 earthquake and trigger a tsunami, as happened in Japan in 2011. Such a scenario could kill over 10,000 people, injure over 30,000 people, and cause upwards of $70 million in economic loss in Washington, Oregon, and California (CREW, 2013). A disaster of this magnitude would delay emergency response from state and federal agencies, thus requiring locals to be ready to respond (Pittman, 2017). People who are ready to respond will have prepared (Chapter 3). However, it is likely that they will still need to rely on others for post-disaster support.

Since 2005, the Federal Emergency Management Agency (FEMA) has required all States and Territories to plan, train, and exercise protocols to prevent, prepare for, respond to, and recover from terrorist attacks and other major disasters or emergencies based on the National

Incident Management Systems. In 2016 the Washington State Emergency Management Division ran the Cascadia Rising drill to the Pacific Northwest's ability to respond to a CSZ earthquake and tsunami in Washington State and found that residents and state response agencies were not ready (Washington Military Department, 2016). The state recommends people being prepared to survive on their own for three days for evacuation and 14 days for staying at home (Washington State Emergency Management Division, 2021). For people living along the coast, the state recommends having three weeks of supplies (Pittman, 2017). Increasing the number of days of supplies households should set aside for a catastrophic disaster reflects the hazard risks and the lack of institutional capacity to respond within a few days. Longer wait times for state and federal response to disasters put more pressure on local communities to be more prepared than ever.

In 2011, FEMA began focusing on a whole community approach to disasters where everyone is responsible for emergency management (DHS & FEMA, 2011). This approach includes concepts of social capital; however, utilizing these resources has yet to be fully realized. There is evidence that people rely more on friends and family than the government to prepare for natural disasters (Tyler & Sadiq, 2018). There is evidence that people rely on their neighbors during daily and extreme event emergencies (LaLone, 2012). Social capital resources and networks such as friends, family, and neighbors are important for community resilience but are often overlooked or devalued as insignificant by planners and policymakers (Aldrich & Meyer, 2015; Dynes, 2006; LaLone, 2012; Tierney, 2014).

In a society where historical social, political, and economic processes advantage and disadvantage people based on race, ethnicity, class, and gender – minorities, the poor, and non-males are disadvantaged before and after disasters (Blaikie et al., 1994; Fordham et al., 2013; Howell & Elliott, 2019; Mileti, 1999; Wisner et al., 2004). The creation of social vulnerability calls into question fairness and trust in society and politics across different groups. Researchers have found that disadvantaged communities are concerned that post-disaster resources will be distributed inequitably across community types (Got Green & Puget Sound Sage, 2016). Researchers have also found that post-disaster resources have been distributed unequally within disadvantaged communities in the past (Nguyen & Salvesen, 2014). When the fair and just distribution of resources is questioned, perceptions of trust are also questioned (You, 2012). Feeliings of fairness and trust can impact how people prepare for disasters and who they expect to rely on post-disasters. Given the expected demand for assistance and delayed response from state and federal institutional actors, our research asks, whom will people turn to for help in a CSZ event, and why? This study examined whether preparedness, fairness, and trust predict reliance on one's household members, people in the neighborhood, and local professional responders (fire, police, and emergency personnel). The study used data from a mail survey sent to a random sample of Seattle households (N=1,342) stratified by zip codes selected for their contrasting demographic characteristics called South Seattle (ethnically diverse, low-income, less formally educated) and Other Seattle (predominantly white, middle- to high-income, more formally educated).

1.1 Fairness and social trust

There are different conceptualizations of social capital (Aldrich, 2012a). In the broadest sense, it is understood as resources generated through social cohesion which can be used by individuals for collective action or community benefit (Reininger et al., 2013a). General reciprocity is the "touchstone of social capital" (Putnam, 2000a, p. 134). Generalized reciprocity refers to a person doing something for someone else with the expectation that *someday* the receiver or someone else will do something in return for the giver. There is no expectation that something is given back immediately in return. The giver simply trusts that they will get something back sometime in the future. Some trust studies have shown that resilient communities have high levels of trust before and after a disaster (Aldrich, 2012a; VanLandingham, 2017). Scholars and practitioners are encouraged to account for social capital as a resource in disaster preparedness and response (Aldrich, 2011, 2012b, 2017; Dynes, 2002; Reininger et al., 2013a).

Social capital varies across different people and communities. Xavier de Souza Briggs (1998) argues that researchers and policymakers should pay attention to two forms of social capital as an individual good: social support and social leverage (characterized, respectively, as bonding and bridging social capital by Woolcock and Narayan (2000)). Social *support* is a form of social capital that helps people "get by" or cope with everyday life. Although all people need social support the poor routinely use it as a substitute for money to get by day-to-day. For example, poor moms share caregiving tasks or give people a ride to church (de Souza Briggs, 1998). Regularly caring for one another and sharing resources in this way shows that people trust each other as they give and take when needed knowing that the favor will be returned someday. They rely on one another to make ends meet. Trust that is embedded in these types of social relations are strong, frequent and nest in social networks are sometimes called "thick trust" (Putnam, 2000b). Social *leverage* helps people "get ahead" by opening up opportunities and connections for advancing one's goals in life. An example of social leverage is when an inner-city kid gets a shot at a life-altering scholarship through a personnel connection (de Souza Briggs, 1998). This personal influence enables someone to move up the socioeconomic ladder or "get ahead". Recommending someone for a scholarship based on a weak and infrequent social connection rests on "thin trust." This type of trust can be more useful than thick trust because it extends trust beyond the people one knows really well (Putnam, 2000b).

Scholars argue that trust is a key component for social cohesion, economic efficiency, and stable democracies (Bourdieu, 1986; Coleman, 1988; Putnam, 2000a). Trust in this sense is about social trust and not trust in government or other institutions. Trust in people is distinctly different than trust in political and institutional actors, yet both are central to healthy democracies (Putnam, 2000b). While different, scholars ask is there a relationship between the two types of trust? At an aggregate national level, Newton (2001) found evidence of a relationship between social and political trust. A more recent study found growing evidence of a relationship between the two types of trust in individual level data as well (Newton et al., 2017).

Many studies have found that social trust is higher and easier to maintain in homogeneous societies than in heterogeneous societies (You, 2012). Scholars have found that it is easier to trust similar people as compared to dissimilar people in terms of race, ethnicity, and income (Alesina & la Ferrara, 2002). This is problematic in heterogeneous societies where there is racial and ethnic diversity and income inequality. You (2012) argues that if social trust is undermined by heterogeneity, then the goods it provides will be more difficult for societies to achieve. In a study on fairness and social trust across countries, You (2012) uses John Rawl's (1999) conceptualization of "justice as fairness," (distributive, procedural, and formal justice) to explore whether homogeneity or fairness better explains social trust across countries. You argues that "fairness in terms of distributive, procedural, and formal justice produce stronger trustworthiness" (2012, p. 703). You finds: 1) that fairness variables positively correlate with trust after controlling for ethnic diversity and per capita income; 2) a negative influence on income inequality is associated with unfairness as compared to homogeneity, and 3) the inclination to trust members of minority groups varies depending on fairness. In other words, fairness matters more than homogeneity.

What does this mean for fairness and trust in American cities and specifically, Seattle? American cities are replete with examples of unfair practices, such as the dispossession of land from the indigenous populations, exploitation of enslaved Africans for capitalistic gain, disposition of land and property of Japanese Americans during World War II, and racist housing policies that segregated white people from other races. In Seattle, Washington, redlining and racially restrictive housing covenants excluded some Jewish and non-white people from getting loans and living in new suburbs. The Central District and International District, located in South Seattle, became the only neighborhoods where people of color could live (Morrill, 2013; Silva, 2018). Economic and social restructuring along with high-density development are some more policies that displaced Black populations further south into the Rainer Valley and beyond city limits (Morrill, 2013). These policies have had long-lasting ramifications. In 2010, the Rainer Valley was celebrated as the most diverse zip code in the nation (Seattle Times Staff Writer, 2010). At the same time, residents in these historically redlined neighborhoods have been at the highest risk of being displaced by gentrification (Seattle Office of Planning & Community Development, 2016).

People leaving their neighborhoods may reduce social capital across a community because social capital consists of relations between people. When people move away those remaining may feel a sense of loss, part of that loss being the weakening of norms (Coleman, 1988). Furthermore, when people move away and into a new neighborhood, they generally meet new people and learn the norms of the area. This takes time and effort, to build new social relations and develop trust.

To examine these relationships, this study examines two starkly different types of communities, South Seattle and Other Seattle (Figure 1). As mentioned above, those living in South Seattle are ethnically diverse, lower-income, and tend to be less formally educated than those living in

the more predominately white, higher income, and more formally educated communities that is called Other Seattle in this study.

Previous investigations into expected reliance examined who people rely on post-disaster (FEMA, 2014; LaLone, 2012; Nguyen & Salvesen, 2014; Tyler & Sadiq, 2018). This study adds to existing studies by using a random sample survey at a local level, examining contrasting neighborhoods within the same city, and looking at perceived fairness and general reciprocity (social trust) to see how these variables influence reliance on local informal (household members and people in the neighborhood) and professional (fire, police, emergency personnel) responding groups post-disaster.

1.2 Research aims, questions, and hypotheses

The broader research aims of this study are to inform policymakers about who people expect to rely on post-disaster and why. In a large-scale disaster that disrupts daily life, people will need help from others, whether it is family, friends, neighbors, local organizations, or government organizations. The study question is, who do people turn to for help, and why? The focus was on reliance on informal (household members and people in one's neighborhood) and local professional (fire, police, and emergency personnel) responding groups.

The expectation was that perceptions of fairness and general reciprocity to positively influence reliance on informal and local professional responding groups. The expectation was that respondents asked about sharing resources (community disaster preparedness, CDP) with their family, friends, and neighbors would report relying more on their informal responding groups and less on local professional responding groups than respondents asked about having individual resources (individual disaster preparedness, IDP).

As found in previous studies (FEMA, 2014; LaLone, 2012; Tyler & Sadiq, 2018), a hypothesis in the study was that people would be most likely to rely on household members above all other groups for assistance following a disaster. As also found in an earlier FEMA study (2014), another hypothesis in the study was that people would report higher expected reliance on professional responders than on people in their own neighborhood.

In addition, because of the historical marginalization of minority populations (Morrill, 2013; Seattle Office of Planning & Community Development, 2016; Seattle Times Staff Writer, 2010; Silva, 2018), a hypothesis in the study was that more diverse communities (South Seattle in this study) would perceive lower levels of fairness than predominantly white communities (Other Seattle in this study). The expectation was that both types of communities to report the same levels of general reciprocity (social trust). Another hypothesis in the study was that people with more preparations would rely more on informal responding groups, and less on local professional responders.

Further, another hypothesis was that preparedness measurements (preparedness counts, food, and water), perceived fairness, perceived reciprocity, might also influence people's expected reliance on household members, people in the neighborhood, and local professional responders. Based on the goals of preparedness (FEMA, 2014; Seattle Office of Emergency Management, n.d.), the expectations was to see increases in reliance on household members and people in one's neighborhood with higher preparedness, because preparedness is everyone's responsibility. As FEMA has found (2014), the expectation in the study was to see less reliance on local professional responders when preparedness increases because they could rely on informal response groups. Based on fairness and trust studies (Newton et al., 2017; Putnam, 2000b; You, 2012), the expectation in the study was to see a positive influence on reliance across all response groups when perceived fairness and general reciprocity are positive.

There was an expectation to see no differences in reliance on informal responder groups (household members and people in the neighborhood) between predominantly diverse communities (South Seattle) and predominantly white communities (Other Seattle). However, was an expectation to see respondents in South Seattle (SS) rely less on local professional responders than respondents in Other Seattle (OS). As others have found (Nguyen & Salvesen, 2014; Tierney, 2014; Tyler & Sadiq, 2018), reliance on responding groups was expected to vary across different race and origin categories. Some race or origin groups might rely more on certain response groups than others based on historical processes (Bolin & Kurtz, 2018). For example, the history of slavery, Jim Crow laws, and segregation might lead Black and African Americans to distrust government institutions therefore relying less on professional responders than informal responders. In 1975 Washington State Governor Dan Evans welcomed Vietnamese refugees to the state and encouraged churches, organizations, and businesses to support them (The Seattle Times editorial board, 2015). This level of support from society and the government could lead to feelings of fairness and trust.

As others have found (Thomas et al., 2013; Tierney, 2014), the expectation was to see socioeconomic variables predict reliance on responding groups, for which reason the study examined and controlled for age, gender, and income. There are many reasons why age would predict reliance on responding groups. Elderly people (65 years and older) are less likely to receive hazard warnings, a growing number of the elderly are living alone, and have limited physical and mental capabilities (Thomas et al., 2013). For these reasons, older people were expected to rely more on people in the neighborhood and professional responders but expected to see no difference in reliance on household members as people age. Regarding gender, certain men, especially those in search and rescue jobs, strong male leaders, and men in construction jobs play a more visible role in immediate response. Men tend to make their way to the center of damage to help strangers whereas women tend to help their family first (Thomas et al., 2013). For this reason, non-males were expected to rely more than males would on people in the neighborhood and professional responders. However, no difference in reliance was expected on household members by gender. Income plays a role in one's ability to make

self-protective measures to prepare for disasters (Tierney, 2014). Increased income was expected to positively influence household reliance whereas income could have a negative influence on reliance on people in the neighborhood and local professional responders.

There was an expectation that people living in a single-family home would be living with other people and so would like to rely on household members. And while there is no data in this study on homeownership in our study, research has found that homeownership encourages investment in local amenities and social capital because of mobility barriers (DiPasquale & Galaeser, 1999). While imperfect, 'single-family home' was used as a proxy for homeownership. Hence, the expectation was that respondents living in a single-family home will be more reliant on people in the neighborhood and less reliant on local professional responders than those living in other types of housing. The study also looked at neighborhood tenure and expected no difference in reliance on household members by tenure, positive associations with reliance on people in one's neighborhood, and negative associations of tenure with reliance on local professional responders (i.e., the longer one has lived in one place, the less one would expect to rely on local professional responders).

2. Methods

2.1.1 Survey

Our survey design was informed by prior research on disaster preparedness and social capital (Akbar & Aldrich, 2017; Dunn et al., 2016; FEMA, 2014; Reininger et al., 2013b; Turner et al., 1986). A total of 18 questions were developed to measure earthquake experience, disaster preparedness, social capital, housing tenure, hazard awareness, demographics, and reliance on post-disaster assistance. Preparation questions were asked in two different ways (Table 2). One survey focused on individual preparedness resources (individual disaster preparedness, IDP) whereas the other survey focused on shared preparedness resources (community disaster preparedness, CDP). All the other questions were identical. Two survey types were developed to test whether assessments of preparedness (i.e., readiness), would differ if people were asked about shared (community) resources (CDP) instead of individual household resources (IDP). The expectation was that CDP would positively influence reliance on household members and people in the neighborhood while having a negative influence on reliance on local professional responders

2.1.2 Sample

A paper survey was mailed to a random sample of 4,600 Seattle households stratified by zip codes selected for their contrasting demographics (Figure 1). Zip codes in South Seattle (SS) are more ethnically diverse and lower socioeconomic status than zip codes in Other Seattle (OS). Historical processes contributed to the stark differences between the two communities. Within each zip code, participants were randomly assigned either an IDP or CDP survey. Twenty-eight

hundred surveys were sent to South Seattle and 1,800 surveys were sent to Other Seattle (see Appendix A). More surveys were mailed to South Seattle because to try represent racial and ethnic variability. Oversampling of small subpopulations is commonly done to make sure the resulting sample is large enough to analyze. Each envelope contained a cover letter explaining the study, a survey, a pre-paid return envelope, and a two-dollar bill (pre-commitment) incentive. Two reminder postcards were also mailed.

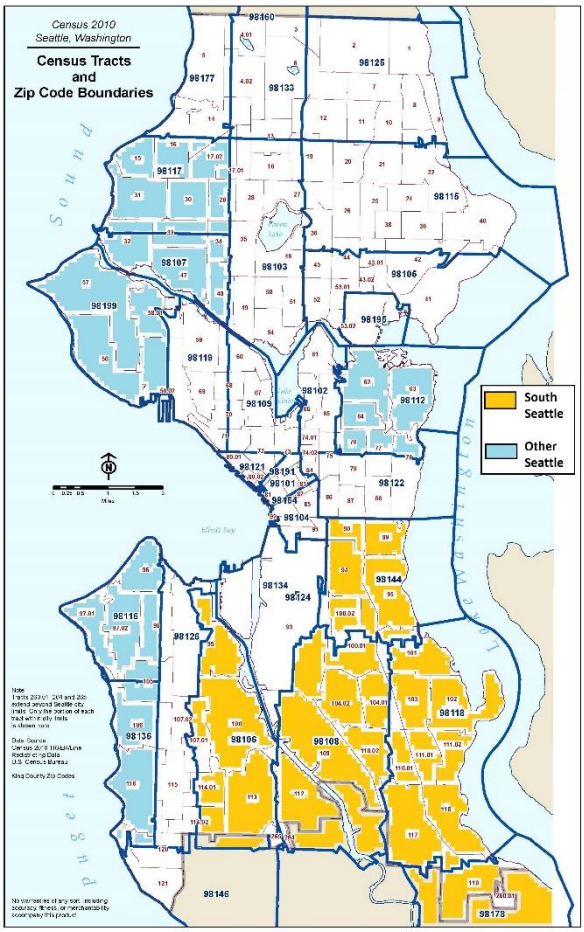

Figure 1. Map of the study area.
Source: City of Seattle Office of Labor Standards

2.2 Measuring reliance post-disaster

The respondents were asked to answer a question about reliance, to help local government better understand how to improve community preparedness. The question was taken directly from *Preparedness in America* (FEMA, 2014, p. 62) (Table 1). This question asked them to indicate how much they would expect to rely on household members, people in their neighborhood, non-profit organizations, their faith community, local professional responders fire, police, and emergency managers), and state and federal government agencies for assistance in the first 72 hours following a disaster. The question was asked on a five-point Likert scale ranging from 1 'do not expect to rely on at all' to 5 'expect to rely on a great deal' to measure expected reliance post-disaster. To assess potential drivers of reliance on informal versus formal support, the analyses presented here focus on household, neighborhood, and local professional responders (fire, police, and emergency personnel), the dependent variables in this study.

Table 1. Reliance post-disaster question

This extra question will help the local government better understand how to improve community preparedness.
In the first 72 hours following a disaster, please indicate how much you would expect to rely on the following for assistance. *Please use a scale of 1 to 5, with 5 being "expect to rely on a great deal" and 1 being "do not expect to rely on at all."*

	Do not expect to rely on at all				Expect to rely on a great deal
	1	2	3	4	5
Household members	☐	☐	☐	☐	☐
People in my neighborhood	☐	☐	☐	☐	☐
Non-profit organizations, such as the American Red Cross or the Salvation Army	☐	☐	☐	☐	☐
My faith community, such as a congregation	☐	☐	☐	☐	☐
Fire, police, emergency personnel	☐	☐	☐	☐	☐
State and Federal Government agencies, including FEMA	☐	☐	☐	☐	☐

Control variables

Respondents were asked to self-report total household income before taxes. The response categories ranged from '*Less than $25,000'* to *'$200,000 or more'*, with eight categories altogether (see Appendices B and C). Measurements of household income were treated as an ordinal variable, coded from 0-7. Other demographic control variables included age, and gender. Age was treated as a continuous variable. Age was calculated by using the respondent's birth month and year. All respondents were 18 years old or older. The survey asked respondents to self-identify their gender, options included male (0), female (1), and other (2). Gender was transformed into a binary variable for the regression analysis where '*other'* was recoded as one because people not identifying as males are more vulnerable.

The survey asked what type of building people lived in. Housing type was a categorical variable; response options included *'Single-family'* (1), *'Multi-family'* (2), *Other (specify)* (3), and *'Don't know'* (4). The categorical variable was transformed into a binary variable for the regression analysis. Living in a single-family home was coded as one; all other categories were coded as zero.

Predictor variables

As noted above, the hypothesis for reliance on responding groups depends on measurements of social capital, preparedness, neighborhood tenure, and different types of communities to predict reliance post-disaster.

For perceived fairness, respondents were asked to pick one statement that resonated most with them from these two: '*most people would try to take advantage of you if they got the chance'* or *'most people would try to be fair*.' The responses were coded as not fair (0) or fair

(1), respectively. For perceived reciprocity respondents were asked to pick one statement that resonated most with them from these two: *'most of the time people try to be helpful'* or *'most of the time people are mostly just looking out for themselves'*. Responses were coded as reciprocal (1) or not reciprocal (0), respectively. Both questions were adapted from the General Social Survey (NORC at the University of Chicago, 2021).

Three preparedness variables were also included. They are preparedness count, food, and water (Table 2). For preparedness count, the survey asked respondents who received the IDP survey, 'Which of these preparations for a disaster do you have? *(Check all that apply)*'. The respondents who received the CDP survey were asked, 'Which of these preparations for a disaster do you have, or could you rely on friends, family and neighbors for? *(Check all that apply)*.' The options were: *flashlight with batteries or solar*; *radio with batteries or solar*; *first aid kit*; *emergency plan*; *secured heavy furniture to the walls*; *supply of water and non-perishable food*; and *none of the above*. For food preparedness, the survey asked respondents who received the IDP survey, 'How many days' worth of food do you have at home? *(Select one).'* The respondents who received the CDP survey were asked, 'Consider how you and your family, friends, and neighbors might share. About how many days' worth of food do you have available, altogether? *(Select one)'.* The options were *None, 1-3 days, 4-6 days, 1-2 weeks, 3-4 weeks,* or *More than 4 weeks*. For water, we used the same question and response options for food except we switched out the word 'food' and replaced it with 'water' in the question. For preparedness count, response options were coded as zero (unselected) and one (selected). Excluding *'None of the above'*, the responses were added up to create counts for each respondent. For food and water preparedness, the responses were coded from zero to six based on the number of days' worth of supplies.

The type of community respondents live in was measured. This variable indicates whether the respondent lives in predominately minority community of South Seattle (SS) or predominantly white community of Other Seattle (OS) zip codes. Respondents living in Other Seattle zip codes were coded as 0 and South Seattle zip codes were coded as 1.

Table 2

Preparedness questions by variables and survey type

Variables	**Survey type**	**Question**	**Response options**	**Code**
Preparedness count	IDP	Which of these preparations for a disaster do you have? *(Check all that apply):*	Flashlight with batteries or solar	0, 1
			Radio with batteries or sola	0, 1
			First aid kit	0, 1
	CDP	Which of these preparations for a disaster do you have, or could you rely on friends, family and neighbors for? *(Check all that apply)*	Emergency plan	0, 1
			Secured heavy furniture to the walls	0, 1
			Supply of water and non-perishable food	0, 1
			None of the above (excluded from the count)	
			Preparedness count	**0-6**
Variables	**Survey type**	**Question**	**Response options (Ordinal code; Lower bound pts)**	**Code**
Food	IDP	How many **days' worth of food** do you have at home? *(Select one)*	None (0; 0)	0; 0
			1-3 days (1; 1)	1; 1
			4-6 days (2; 4)	2; 4
	CDP	Consider how you and your family, friends, and neighbors might share. About how many **days' worth of food** do you have available, altogether? *(Select one)*	1-2 weeks (3; 7)	3; 7
			3-4 weeks (4; 21)	4; 21
			More than 4 weeks (5; 29)	5; 29
Water	IDP	How many **days' worth of water** do	None (0; 0)	0; 0

		you have at home? *(Select one)*	1-3 days (1; 1) 4-6 days (2; 4) 1-2 weeks (3; 7) 3-4 weeks (4; 21) More than 4 weeks (5; 29)	1; 1 2; 4 3; 7 4; 21 5; 29
	CDP	Consider how you and your family, friends, and neighbors might share. About how many **days' worth of water** do you have available, altogether? *(Select one)*		

As noted above, the two types of surveys assigned (randomly within zip code) were individual disaster preparedness (IDP) or community disaster preparedness (CDP), coded as 0 and 1, respectively.

As mentioned earlier, single-family home is a proxy for homeownership in this study and homeownership is associated with wealth. In general, other types of housing is less expensive and less likely to be owner occupied. The survey asked how long people lived in their neighborhood. The response options included, *'0-2 years'* (0)*, '3-5 years'* (1)*,* and *'More than 5 years'* (2).

For race and origin, the survey asked, 'What is your race or origin? '. The response categories included White, Black or African American, Native Hawaiian or Other Pacific Islander, American Indian or Alaska Native, Hispanic, Latino, or Spanish origin (specify), Asian (specify), and Other race or origin (specify). We disaggregated the Asian data using information provided by the respondent. If there were more than 20 respondents self-identifying as something other than Asian, a new category was created. Those categories are Chinese, Filipino, Japanese, and Vietnamese. All other Asian origins remained in the Asian category. Other categories were examined for disaggregation but there was not enough information to do so meaningfully. Categories for 'Some Other Race or Origin Alone' and 'Two or More Races or Origin' were also created for the study. Dummy variables were created for race and origin with White as the reference category for the regression analysis.

2.1.2 Data analysis

Independent sample t-tests were used to gauge whether there were differences in South and Other Seattle reliance by response group. One-tailed paired sample t-tests were used to gauge whether respondents expected to rely on certain response groups more than others. Multivariate linear regressions were conducted to investigate the influences of social capital and other variables of interest on measures of reliance. Survey responses were transformed for

the multivariate linear regression analyses, as noted above. Multicollinearity was examined by calculating the variance inflation factor. Statistical analysis was conducted in SPSS version 27.

3. Results

3.1 Sample

The response rate was 29 percent overall, with 641 responses (IDP=311, CDP=330) out of 1,800 from Other Seattle zip codes (36% response rate) and 699 responses (IDP=353, CDP=346) out of 2,800 from South Seattle zip codes (25% response rate), for a total of 1340 responses.

The Other Seattle sample was more representative of the population of those zip codes than the South Seattle sample was of the South Seattle zip codes (Table 3). For example, the difference between the population and sample for the Other Seattle White Alone group was 4.8% (79.5% in the population, 84.3% in the sample) as compared to a difference of 23.4% for South Seattle (34.3% in the population, 57.7% in the sample). Minority races were underrepresented in both community types although the underrepresentation was smaller for Other Seattle than for South Seattle. Disaggregated Asian categories were not available at the zip code level on Social Explorer, for which reason all Asian categories were aggregated for reporting purposes. As noted above, Asian category was disaggregated and new categories for Chinese, Filipino, Japanese, and Vietnamese were created. Other respondents self-reporting as Asian remained in the Asian category.

Table 3
Race or Origin

	POPULATION				SAMPLE			
	OS		SS		OS		SS	
Race or Origin	**Count**	**Percent**	**Count**	**Percent**	**Count**	**Percent**	**Count**	**Percent**
American Indian and Alaska Native Alone	371	0.20%	945	0.60%	1	0.16%	1	0.15%
Asian Alone	10,627	6.80%	41,731	26.30%	38	6.03%	138	20.26%
Black or African American Alone	3,153	2.00%	32,312	20.40%	8	1.27%	62	9.10%
Hispanic or Latino	8,662	5.60%	16,010	10.10%	17	2.70%	29	4.26%
Native Hawaiian and Other Pacific Islander Alone	153	0.10%	1,297	0.80%	0	0.00%	5	0.73%
Some Other Race Alone	178	0.10%	670	0.40%	5	0.79%	11	1.62%
Two or More Races	8,811	5.70%	11,146	7.00%	30	4.76%	42	6.17%
White Alone	123,753	79.50%	54,423	34.30%	531	84.29%	393	57.71%
Total	155,708	100.00%	158,534	99.90%	630	100.00%	681	100.00%

Source: Social Explorer Tables: ACS 2019 (5-Year Estimates) (SE), ACS 2019 (5-Year Estimates), Social Explorer; U.S. Census Bureau

In Other Seattle respondents earning less than $25,000 are underrepresented in the sample (4.61%) as compared to the population (8.91%). All other categories of income are well represented. In South Seattle, respondents earning less than $25,000 are underrepresented in the sample (10.89%) as compared to the population (17.30%) whereas respondents earning more than $200,000 are overrepresented in the sample (15.58%) as compared to the population (10.66%). All other categories of income are well represented (Appendix A, Table 1, Income).

In Other Seattle, respondents ages 18-34 years are underrepresented in the sample (18.80%) as compared to the population (39.32%). Respondents ages 65+ are overrepresented in the sample (26.74%) as compared to the population (16.37%). The other categories of age were well represented. In South Seattle, age categories 18-34 and 35-54 were underrepresented in the sample (17.15) as compared to the population (32.14%). Age categories 34-54 and 65+ years were overrepresented in the sample (42.88% and 25.27% respectively) as compared to the population (36.24% and 16.88% respectively). Respondents in the 55-64 years category were well represented. Overall, both samples skew older than the population (Appendix A, Table 2, Age).

Gender was nearly balanced in the sample between male (49%) and female (50.5%). A small percentage of respondents self-reported another gender (0.5%).

3.2 Summary statistics

Reliance within the first 72 hours after an earthquake was measured on a Likert scale ranging from 1 'Do not expect to rely on at all' to 5 'Expect to rely on a great deal'. Majorities of both South Seattle (58.3%) and Other Seattle (59.7%) expect to rely a great deal (5) on household members, although slightly more people in Other Seattle (17.6%) do not expect to rely (1) on household members at all as compared to South Seattle (15.1%) (Figure 2). In other words, both South and Other Seattle respondents expect to rely a good deal on household members. As illustrated in Figure 3, expected reliance on people in the neighborhood is normally distributed. The majority of South (33.2%) and Other Seattle (37.5%) respondents are neutral (3) to neighborhood assistance. The percentage of respondents who expect to rely on the neighborhood decreases at greater (4-5) and lower levels (1-2) of reliance. Reliance on local professional responders (fire, police, and emergency personnel) is skewed on the higher ends (Figure 4). Respondents in South Seattle (31.2%) expect to rely a great deal on local professional responders as compared to Other Seattle (27.6%). Table 4 shows the reliance means for each response group by community type, with 95% confidence intervals. Independent sample t-tests were conducted to test if there was a difference of means between South Seattle and Other Seattle for each response group and found no statistical difference.

The reliance means for household members (3.94), people in my neighborhood (3.12) and fire, police, and emergency personnel (3.55) differed. Several one-tailed paired sample *t* tests were

performed to test whether respondents relied more on 1) households than on other response groups and 2) local professional responders than on the neighborhood (Table 5). These tests revealed that respondents expect to rely more on household members than the neighborhood and local professional responders, as expected. Tests also revealed that respondents expect to rely more on local professional responders than on the neighborhood, as expected.

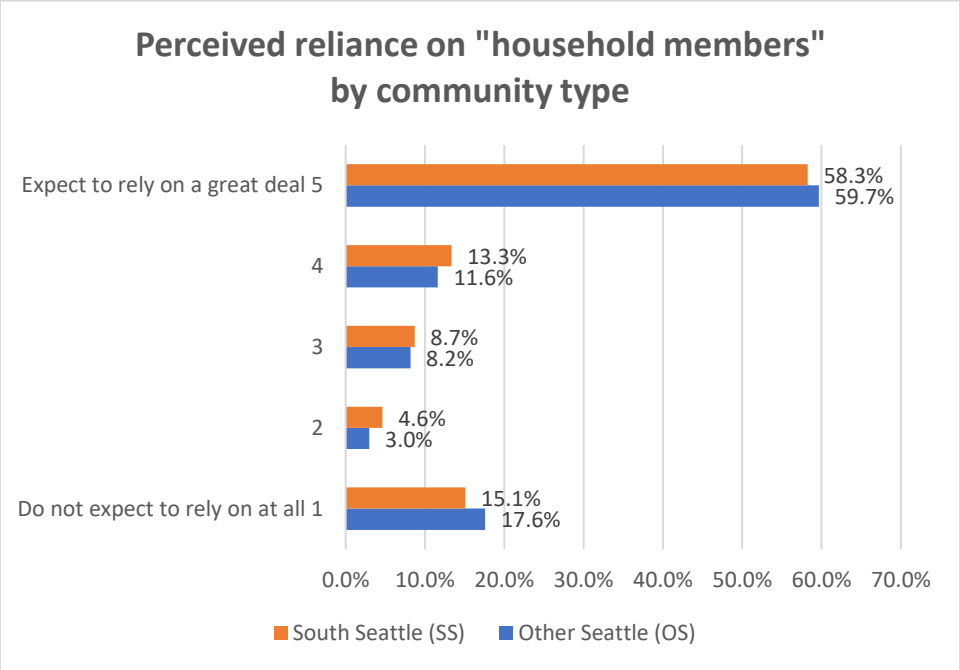

Figure 2. Perceived reliance on "household members" by community type (South Seattle *N* = 690; Other Seattle *N*=637).

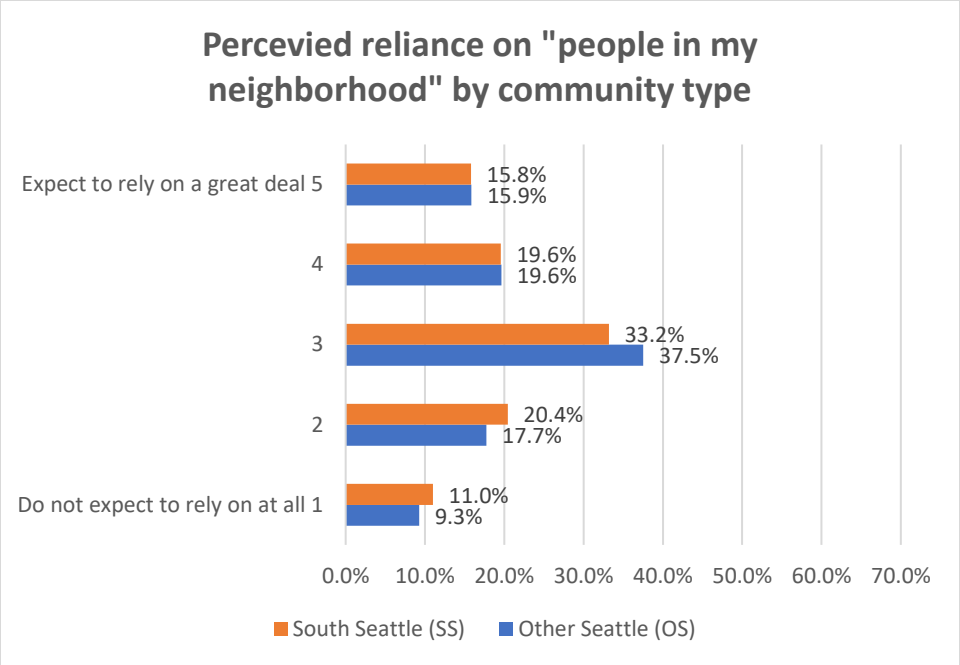

Figure 3. Perceived reliance on "*people in my neighborhood*" by community type (South Seattle *N* = 690; Other Seattle *N*=637).

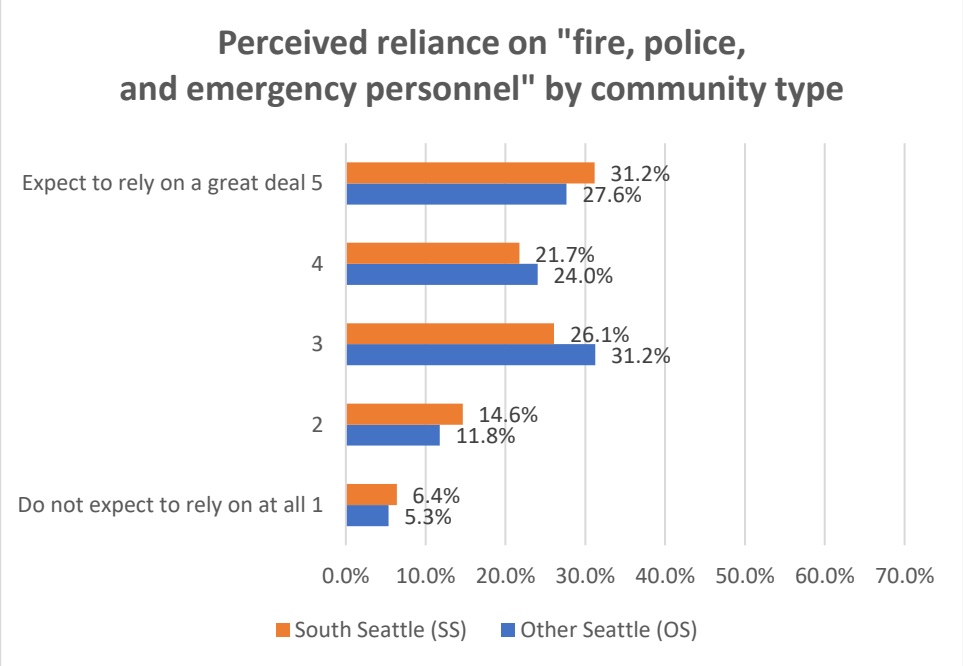

Figure 4. Perceived reliance on fire, police, and emergency personnel by community type (South Seattle *N* = 690; Other Seattle *N* = 637).

Table 4. Reliance means by response group and community type (South Seattle *N* = 690; Other Seattle *N*=637) on a scale of 1 to 5, with 5 being "expect to rely on a great deal" and 1 being "do not expect to rely on at all." Independent sample t-tests revealed no significant difference between means by community type for each response group.

			95% CI	
Response group	Community type	Mean Reliance	Lower Bound	Upper Bound
Household members	Other Seattle (OS)	3.93	3.81	4.05
	South Seattle (SS)	3.95	3.84	4.06
People in my neighborhood	Other Seattle (OS)	3.15	3.06	3.24
	South Seattle (SS)	3.09	3.00	3.18
Fire, police, emergency personnel	Other Seattle (OS)	3.57	3.48	3.66
	South Seattle (SS)	3.57	3.47	3.66
Average Reliance		3.54		

Table 5. One-tailed paired sample t-tests (*N*=1329) comparing means of response groups.

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig.
Pair 1	Household - Neighborhood	0.825	1.670	0.046	0.736	0.915	18.019	1328	0.000
Pair 2	Household - Fire, police, emergency personnel	0.374	1.863	0.051	0.274	0.474	7.318	1328	0.000
Pair 3	Neighborhood - Fire, police, emergency personnel	-0.451	1.504	0.041	-0.532	-0.371	-10.945	1328	0.000

3.3 Social capital

As expected, the results revealed that the percentage of respondents who think that most people try to be fair is higher in Other Seattle (*N*=632; 83.7%) than in South Seattle (*N*=681; 75.6%). Conversely, this means that more respondents in South Seattle (24.4%) feel that most people would try to take advantage of them if they got the chance than in Other Seattle (16.3%) (Figure 5). To test the hypothesis that Other Seattle *M*=.84 (*SD*=.370) has higher perceived fairness than South Seattle *M*=.76 (*SD*=.430), a one-tailed independent sample *t* test was

conducted. The test result revealed that Other Seattle perceives more fairness than South Seattle respondents, $t(1303.6)=3.660$, $p<.001$.

Most respondents in Other Seattle (N=632) and South Seattle (N=687) think that most of the time people try to be helpful (80.2%; 71.2% respectively), as expected. Conversely, a lower percentage of Other Seattle (19.8%) and South Seattle (28.8%) responders believe that people are just looking out for themselves (Figure 6). The mean response for Other Seattle is .80, for South Seattle is .71. To test the hypothesis that there is no difference in perceived reciprocity between Other Seattle and South Seattle, an independent sample t test was conducted. Unexpectedly, the results revealed that there is a statistically significant difference between the two community types, with lower perceived reciprocity in South Seattle $t(1314.37) = 3.854$, $p<0.001$.

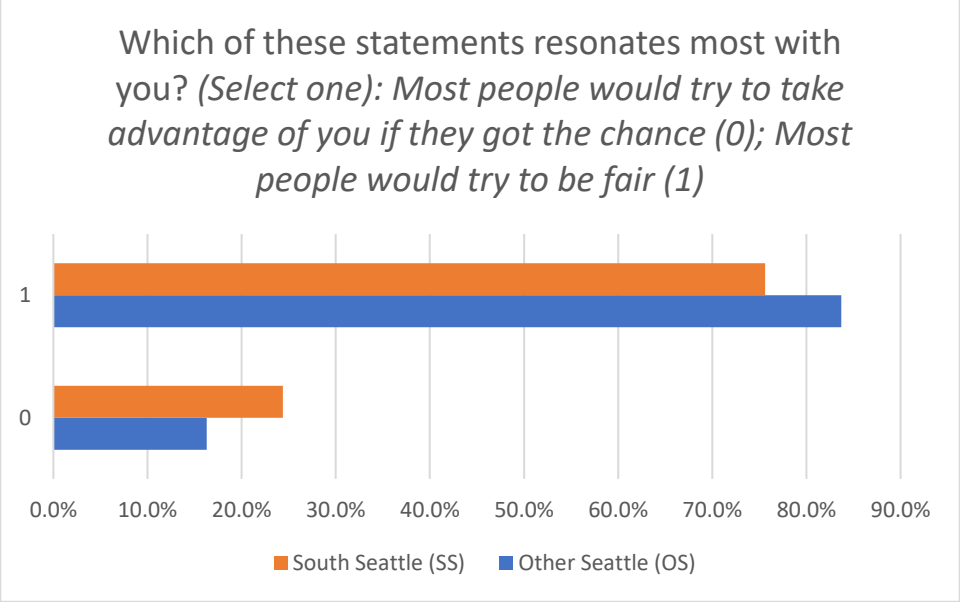

Figure 5. Perceived fairness by community type (South Seattle vs Other Seattle)

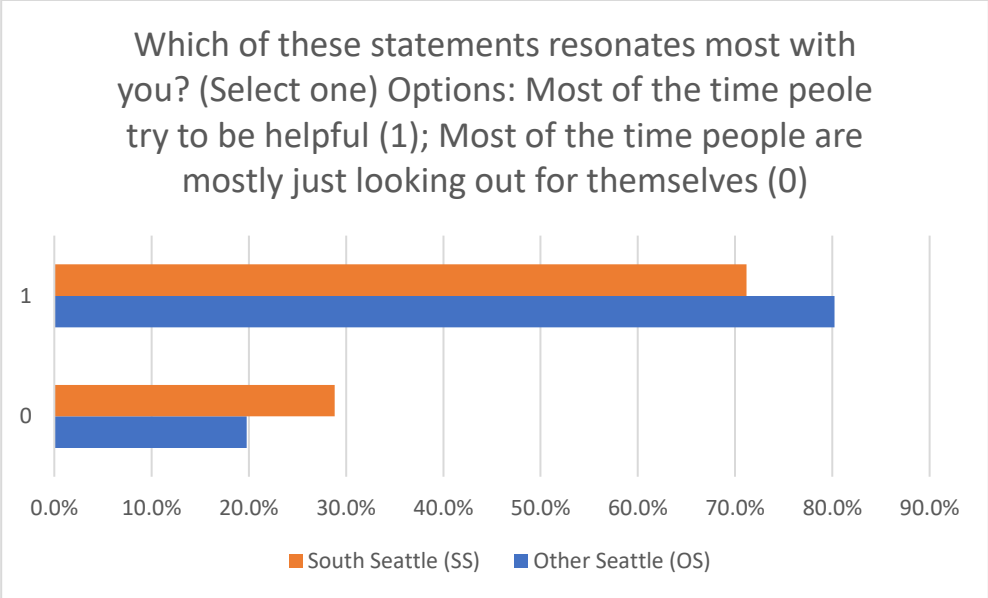

Figure 6. Perceived general reciprocity by community type (South Seattle vs Other Seattle)

3.4 Model Results

(Table 3). Reliance on household, neighborhood, and fire, police and emergency managers were the dependent variables in three multivariate linear regressions.[5] Standardized coefficients were reported, and bolded variables are significant at the 5% or 10% level for at least one model.

3.5. ***Household model***

3.5.1 Demographic and socioeconomic variables

To our surprise, age is statistically significant with a negative coefficient after controlling for other variables. This suggests that older people expect to rely less on household members than younger people. Income and single-family home are statistically significant and have positive coefficients after controlling for other variables, as expected. There is no difference between genders after controlling for other variables, as expected. Age, income, single-family home, and gender are control variables in the model.

[5] The variables for multicollinearity was checked and the results revealed that each variable had a variance inflation factor (VIF) of less than 2. A standard rule of thumb is that VIFs greater than 4 warrants more investigation and VIFs greater than 10 are signs of multicollinearity. Thus, multicollinearity is not an issue with variables in the model.

Table 3. Three multivariate linear regression models of reliance by response groups on perceived fairness, perceived reciprocity and other variables. **Note that the Asian category is inclusive of all respondents reporting Asian alone excluding Chinese, Filipino, Japanese, and Vietnamese, which are separate categories in the regression.

Dependent variable	**Household members**		**People in my neighborhood**		**Fire, police, and emergency personnel**	
	Standardized Coefficients Beta	Sig.	Standardized Coefficients Beta	Sig.	Standardized Coefficients Beta	Sig.
(Constant)		0.000		0.000		0.000
Perceived fairness	-0.052	0.112	**0.075**	0.027	0.044	0.184
Perceived reciprocity	**0.060**	0.075	**0.135**	0.000	**0.102**	0.003
preparation count	**0.083**	0.010	**0.091**	0.006	-0.061	0.063
Food	0.019	0.556	-0.043	0.206	**-0.067**	0.044
Water	-0.044	0.204	-0.057	0.107	**-0.060**	0.082
CDP	**0.047**	0.095	-0.043	0.135	**-0.095**	0.001
Neighborhood tenure	-0.036	0.275	-0.002	0.961	**-0.088**	0.008
South Seattle	0.002	0.944	-0.011	0.716	-0.042	0.166
American Indian or Alaska Native	0.037	0.184	**-0.052**	0.069	0.034	0.222
Asian**	0.012	0.673	0.049	0.096	**0.092**	0.002
Black or African American	-0.005	0.870	0.012	0.682	**0.073**	0.013
Hispanic, Latino, or Spanish origin	**0.065**	0.024	-0.007	0.818	0.039	0.175
Native Hawaiian or Other Pacific Islander	-0.036	0.202	-0.025	0.382	0.020	0.472
Some Other Race or Origin Alone	-0.014	0.610	-0.039	0.179	-0.002	0.942
Two or More Races or Origin	**0.054**	0.056	**0.053**	0.071	**0.082**	0.004
Chinese	-0.015	0.588	0.025	0.387	**0.067**	0.019
Filipino	**0.075**	0.008	-0.027	0.354	**0.102**	0.000
Japanese	0.015	0.596	-0.025	0.384	0.002	0.952
Vietnamese	0.033	0.238	0.014	0.620	**0.056**	0.049
Age	**-0.183**	0.000	-0.003	0.935	-0.012	0.734
Female or Some Other Gender	-0.045	0.118	**0.086**	0.004	**0.089**	0.002
Income	**0.133**	0.000	-0.002	0.954	-0.004	0.912
Single-family home	**0.142**	0.000	**0.089**	0.005	-0.016	0.619

In terms of community type, there is no statistically significant difference between respondents in Other Seattle or South Seattle after controlling for other variables, as expected. The expectation was to see statistically significant results for Hispanic, Latino, or Spanish origin, Two or More Races or Origin, and Filipino after controlling for other variables. These categories had positive coefficients. This suggests that these groups will rely more on household members than the white category. As expected, neighborhood tenure is not statistically significant which means that there is no difference in reliance on household members based on how long a respondent has lived in the neighborhood.

3.5.2 Preparations

The expectation was to see household reliance increase with all three preparation variables however, only preparation counts showed a statistically significant result in the direction anticipated after controlling for other variables. There is no difference in expected reliance on the household by the amount of food and water reported after controlling for other variables. There was no difference between IDP and CDP after controlling for perceived fairness and general reciprocity, as expected.

3.5.3 Perceived fairness and perceived reciprocity

The model results reveal a statistically significant positive coefficient for perceived reciprocity (0.059) after controlling for other variables, as expected. This suggests that the more people trust the more they will rely on household members. The model results also revealed no statistically significant result for perceived fairness after controlling for other variables, as unexpected.

3.6. ***People in my neighborhood model***

3.6.1 Demographic and socioeconomic variables

There was no statistically significant difference in age after controlling for other variables. The expectation was to see older people being more reliant on the neighborhood than younger people. Single-family home is statistically significant and have positive coefficients after controlling for other variables, as expected. The lack of statistical difference by income was surprising. The expectation was to see less reliance on people in the neighborhood as income increased. Gender was significant after controlling for other variables, as expected. Respondents who self-report as female or other genders expect to be more reliant on the neighborhood post-disaster as expected. Age, income, and single-family home are control variables in the model.

In terms of community type, there is no statistically significant difference in reliance on people in the neighborhood by community type (South vs. Other Seattle) after controlling for other variables, as expected. The study found that neighborhood tenure is not statistically significant after controlling for other variables. This means that there is no difference in reliance on people

in the neighborhood based on how long a respondent has lived in the neighborhood which was unexpected.

We also expected to see increased reliance on people in the neighborhood across all race and origin categories, however, the results were mixed. After controlling for other factors in the model, self-reporting American Indian or Alaska Natives expected to rely less on people in the neighborhood than white people. Respondents who identify as Asian and Two or more races or Origin expect to rely more on the neighborhood than white people. There was no statistically significant difference in reliance by the other race and origin categories.

3.6.2 Preparations

The more preparation items respondents report having, the more reliant they expect to be on people in the neighborhood, all else equal. The more water a respondent has, the less reliant they expect to be on people in the neighborhood after controlling for other variables, as expected. The coefficient for food (preparedness) is indistinguishable from zero, suggesting that food preparedness is not associated with expected reliance on people in the neighborhood, after controlling for other factors in the model. Finally, there was an expectation to see a positive statistically significant coefficient for CDP but the results reveal no differences between the two survey types, IDP and CDP, after controlling for the other factors in the model.

3.6.3 Perceived fairness and perceived reciprocity

Both perceived fairness (0.075) and perceived reciprocity (0.135) have significant positive coefficients in the model. Those who perceive both fairness and reciprocity expect to rely on people in the neighborhood, as hypothesized, even after controlling for other factors in the model.

3.7 ***Fire, police, and emergency personnel model***

3.7.1 Demographic and socioeconomic variables

More reliance on professional responders for older respondents was expected, however, there was no statistically significant differences by age after controlling for other factors. Unexpectedly, there was also no statistically significant difference in reliance on professional responders by income or by whether or not respondents lived in single-family homes. There was a statistically significant difference by gender: people self-identifying as female or some other gender reported more reliance (positive coefficient) on professional responders, as expected.

In terms of community type, there was no statistically significant difference between respondents living in Other Seattle and South Seattle, after controlling for other factors in the model. As expected, reliance on local professional responders was reduced the longer people live in the neighborhood.

Statistically significant negative coefficients or no differences was expected for the race or origin categories but there were mixed results. Respondents who self-reported as Asian, Black or African American, Two or more races or origin, Chinese, Filipino, and Vietnamese reported higher expectations of relying on local professional responders than did Whites.

3.7.2 Preparations

All the preparation measurements have a negative coefficient and are statistically significant in the model, as expected. This means that the more prepared people are, the less reliant they are on professional responders, after controlling for other factors. Controlling for survey type the results revealed a statistically significant negative difference between IDP and CDP, as expected. This suggests that those who were asked about shared disaster preparedness resources (CDP) reported expecting to rely less on professional responders than did those who were asked about their own disaster preparedness (IDP) controlling for other variables in the model.

3.7.3 Perceived fairness and perceived reciprocity

The model results reveal a statistically significant positive coefficient for perceived reciprocity (0.102) after controlling for other variables, as expected. In the model, perceived fairness was expected to be associated with increased reliance on professional responders. However, although it is positive, the coefficient on perceived fairness is not significantly different from zero.

4. Discussion

When a magnitude 9 earthquake and tsunami or another hazard of similar strikes the Pacific Northwest a full-scale response will be needed to address the people's needs. Since 2005, the federal government had required all States and Territories plan, train, and exercise for small to large scale events to facilitate effective preparedness, response and recovery at all levels. But in 2016, when the Washington State Emergency Management Division ran the Cascadia Rising drill to the Pacific Northwest's ability to respond to a CSZ earthquake and tsunami the state and found that residents and state response agencies were not ready. Households, neighborhoods, and local professional responders need to be more prepared than ever. In our study, the study ask who will people turn to help post-disaster, and why?

Previous research on recovery from disasters has found that perceived fairness and reciprocity foster collaboration (Aldrich, 2012b). In terms of fairness, South Seattle respondents report less fairness than respondents in Other Seattle. This is not surprising given the historical social, political, and economic processes that disadvantaged people in South Seattle have experienced, as compared to those living in Other Seattle. However, in the three models, there were mixed results for perceived fairness. In the people in my neighborhood model, perceived fairness is significant with a positive coefficient, all else equal. Perceived fairness was not statistically

significant in the other two models. All models were expected to have significant positive coefficients. This study used individual level data to measure perceived fairness whereas other studies (You, 2012) included state measures of fairness and used a multilevel analysis. This could be one reason why there were mixed results.

Perceived reciprocity is significant in all three models; the greater the perceived reciprocity, the higher the expected reliance, after controlling for other factors, as found in earlier research (Aldrich, 2012b). There is no statistical difference in perceived general reciprocity by community type.

There is evidence in the models to suggest that the more prepared people are the more likely they will rely on their households and neighborhood. There is evidence that the more prepared people are the less they expect to rely on local professional responders. These results suggest that people expect preparedness to do what it is intended to do: allow people to survive on their own until professional responders arrive if additional assistance is needed.

Finally, the study looked to see if there were differences between racially diverse communities (South Seattle) and predominately white communities (Other Seattle); there were no statistical differences in any of the three models, after controlling for other factors. The study also looked to see if there were differences across different racial categories and found mixed results as expected. Except for the coefficient for American Indian or Alaska Natives in the second model (neighborhood), all the racial category coefficients are significantly different from zero are positive. It is hard to know why this is the case without diving deep into the historical and current processes that marginalize American Indian or Alaska Natives. At a minimum, we could say that American Indian or Alaska Natives have a distinctly different history than other racialized groups because they are indigenous to the area. Indigenous people can be subject to different laws and regulations depending on their tribal standing within the US government which could influence levels of fairness and trust. To that end, each racial group is different from each other due to some inherent differences such as cultures and preferred language but also because of different structural inequities. For example, race and ethnicity are not static categories, as they are transformed through political struggles over time. What bodies fit into which racial categories is representative of place-specific historical processes that produce advantages and disadvantages based on these classifications (Bolin & Kurtz, 2018). As such, racialized group data should be analyzed in relation to relevant data on racialized societal inequities (Krieger, 2021). This type of analysis is beyond the scope of this paper. While minority groups are different than white people, minority groups are also different from each other (Nguyen & Salvesen, 2014; Tierney, 2014). Our main purpose in looking at a wide range of race and ethnic categories is to understand the differences across racial groups. Future studies on specific racial groups that interrogate structural inequities as they relate to place-specific historical processes are merited.

5. Conclusion

One of the greatest threats to the Pacific Northwest is a magnitude 9 earthquake, like the 2011 Great Earthquake and Tsunami in Tohoku, Japan. The events in Japan were devasting and if the Pacific Northwest experiences something of that magnitude, people across the region will need assistance. Previous studies examined reliance on informal and professional responding groups post-disaster however there is limited studies that explore how fairness, social trust, preparedness, and sharing resources could influence expected reliance. Our study revealed some promising results on how these variables of interest can influence reliance on various stakeholders.

There are some limiting factors in the study. First, some racial groups are underrepresented in the sample, despite best efforts. The results were not weighted to reflect the populations in those communities. As mentioned before, the study only used individual level data and not state level data which could have returned better results on some variables of interest. Finally, this study was conducted before the pandemic. Perceptions of fairness, trust, and expectations of reliance might have changed.

Given the long-standing structural inequalities in Seattle, it is no surprise that the results of our test reveal less perceived fairness in South Seattle than in Other Seattle. Societies with fair rules and administration are likely to encourage people to respect the rules and therefore produce norms of trustworthiness. Improving political trust can also enhance social trust (You, 2005). Paying close attention to people's sense of fairness is important to maintaining and improving trust in government and society. In our study, tests reveal that trust matters in all communities (South vs. Other Seattle) and that trust enhances reliance on all response groups. Post-disaster, both fairness and trust will be important for mobilizing support to help those in need.

Additional studies that focus on racial differences as outlined above are necessary for understanding differences across marginalized groups. Understanding the unique assets, experiences with injustice, and needs of different communities will help emergency managers and policy makers better engage appropriately with varying groups.

Finally, the model results suggest that preparedness and sharing resources (CDP) can reduce reliance on local professional responders and improve self-reliance on household members and people in the neighborhood. These are positive results as local professional response will likely be impacted the larger the event. Efforts to improve preparedness and sharing of resources will benefit everyone.

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Appendix A: Study area selection and sampling

Table 1:

Study area selection in Seattle, WA S based on ACS 2017 (5-year estimates) Census Data

Study area	Seattle ZCTA	Total Population	% White Alone	% Speak English Less than "Very Well"	% Bachelor's Degree +	Med HH Income	% Owner Occupied
South Seattle	98178	27279	0.286	0.205	0.276	72478	0.613
South Seattle	98108	24134	0.306	0.288	0.319	55314	0.546
South Seattle	98118	46800	0.33	0.227	0.381	62504	0.578
South Seattle	98144	30850	0.483	0.17	0.503	71628	0.472
South Seattle	98106	26244	0.487	0.15	0.368	62726	0.492
Not in study	98104	14143	0.515	0.173	0.407	37610	0.107
Not in study	98134	844	0.538	0.083	0.325	58125	0.304
Not in study	98146	27587	0.564	0.173	0.294	61160	0.599
Not in study	98121	16466	0.649	0.032	0.725	94813	0.205
Not in study	98133	48390	0.656	0.123	0.438	60409	0.475
Not in study	98122	37270	0.657	0.059	0.653	72018	0.334
Not in study	98105	47128	0.659	0.085	0.752	56015	0.352
Not in study	98125	40803	0.663	0.122	0.545	61014	0.472
Not in study	98126	23360	0.679	0.095	0.509	73698	0.57
Not in study	98101	12408	0.703	0.068	0.6	68750	0.188
Not in study	98109	27002	0.725	0.046	0.745	95719	0.293
Not in study	98102	24703	0.787	0.018	0.743	83403	0.291
Not in study	98115	51523	0.803	0.036	0.731	100794	0.625
Not in study	98119	25036	0.81	0.031	0.733	85171	0.416
Not in study	98177	20278	0.822	0.036	0.629	100036	0.775
Not in study	98103	51385	0.832	0.026	0.739	91740	0.474
Other Seattle	98136	16364	0.832	0.029	0.607	97673	0.673
Other Seattle	98107	24384	0.835	0.019	0.725	83581	0.384
Other Seattle	98199	21660	0.839	0.029	0.68	103309	0.646
Other Seattle	98112	24720	0.85	0.027	0.788	110051	0.548
Other Seattle	98116	25694	0.851	0.017	0.65	100711	0.593
Other Seattle	98117	33610	0.867	0.024	0.68	102519	0.722

Table 2. Sampling by Location

Study Area Zip Codes	Study Area	Majority	IDP or CDP		Responses desired	Final responses desired	Sample sizes
98106, 98108, 98118, 98144, 98178	South Seattle	Non White	IDP	100	175	700	2800
	South Seattle	Non White	CDP	100	175		
	South Seattle	White	IDP	100	175		
	South Seattle	White	CDP	100	175		
98107, 98112, 98116, 98117, 98136, 98199	Other Seattle	White	IDP	100	225	450	1800
	Other Seattle	White	CDP	100	225		
					Total	1150	4600

Table 3. Income

	POPULATION						SAMPLE					
	Other Seattle		South Seattle		Total	Percent	Other Seattle		South Seattle		Total	Percent
Less than $25,000	6352	8.91%	10495	17.30%	16847	12.77%	28	4.61%	72	10.89%	100	7.88%
$25,000 to $34,999	2660	3.73%	4663	7.69%	7323	5.55%	24	3.95%	45	6.81%	69	5.44%
$35,000 to $49,999	4853	6.80%	6417	10.58%	11270	8.54%	39	6.41%	50	7.56%	89	7.01%
$50,000 to $74,999	9096	12.75%	8807	14.52%	17903	13.57%	83	13.65%	102	15.43%	185	14.58%
$75,000 to $99,999	8184	11.48%	6752	11.13%	14936	11.32%	92	15.13%	93	14.07%	185	14.58%
$100,000 to $149,999	14626	20.51%	11303	18.64%	25929	19.65%	115	18.91%	121	18.31%	236	18.60%
$150,000 to $199,999	8462	11.87%	5749	9.48%	14211	10.77%	80	13.16%	75	11.35%	155	12.21%
$200,000 or more	17085	23.96%	6466	10.66%	23551	17.85%	147	24.18%	103	15.58%	250	19.70%
Total	71318	100.00%	60652	100.00%	131970	100.00%	608	100.00%	661	100.00%	1269	100.00%
Social Explorer Tables: ACS 2019 (5-Year Estimates) (SE), ACS 2019 (5-Year Estimates), Social Explorer; U.S. Census Bureau												

Table 4. Age

	POPULATION						SAMPLE					
	OS		SS		Study Area		OS		SS		Study Area	
Age	Count	Percent	Count	Percent	Count	Perecent	Count	Percent	Count	Percent	Count	Percent
18-34 Years	38,293	29.81%	40614	32.14%	78,907	30.96%	116	18.80%	112	17.15%	228	17.95%
35-54 Years	50,505	39.32%	45795	36.24%	96,300	37.79%	245	39.71%	280	42.88%	525	41.34%
55-64 Years	18,634	14.51%	18635	14.75%	37,269	14.62%	91	14.75%	96	14.70%	187	14.72%
65+ Years	21,029	16.37%	21327	16.88%	42,356	16.62%	165	26.74%	165	25.27%	330	25.98%
Total	128,461	100.00%	126371	100.00%	254,832	100.00%	617	100.00%	653	100.00%	1270	100.00%

Social Explorer Tables: ACS 2019 (5-Year Estimates) (SE), ACS 2019 (5-Year Estimates), Social Explorer; U.S. Census Bureau

Appendix B: Individual disaster preparedness survey in English

COMMUNITY PREPAREDNESS SURVEY

1. **Have you personally experienced an earthquake?** *(Select one)*

☐ Yes ☐ No [skip to question 2] ☐ Not sure [skip to question 2]

If Yes: 1a. **Where and when did you experience this earthquake** (your most memorable earthquake)?

Where: _____ When: _____

1b. **How strong was the shaking that you felt?** *(Select one)*

Not felt	Weak shaking (felt, but unsure was a quake)	Mild shaking (dishes, windows, doors shook)	Moderate shaking (dishes, windows broken)	Strong shaking (heavy furniture moved)	Violent shaking (great damage)	Not applicable
☐	☐	☐	☐	☐	☐	☐

2. **Which of these preparations for a disaster do you have**? *(Check all that apply)*

- ☐ Flashlight with batteries or solar
- ☐ Radio with batteries or solar
- ☐ First aid kit
- ☐ Emergency plan
- ☐ Secured heavy furniture to the walls
- ☐ Supply of water and non-perishable food
- ☐ None of the above

3. **How many days' worth of food do you have at home?** *(Select one)*

None	1-3 days	4-6 days	1-2 weeks	3-4 weeks	More than 4 weeks
☐	☐	☐	☐	☐	☐

4. **How many days' worth of water do you have at home?** *(Select one)*

None	1-3 days	4-6 days	1-2 weeks	3-4 weeks	More than 4 weeks
☐	☐	☐	☐	☐	☐

5. **Which of these statements resonates most with you?** *(Select one)*

- ☐ Most people would try to take advantage of you if they got the chance
- ☐ Most people would try to be fair

6. **Which of these statements resonates most with you?** *(Select one)*

- ☐ Most of the time people try to be helpful
- ☐ Most of the time people are mostly just looking out for themselves

7. **In the past 12 months, were you a member or participant in a** *(Check all that apply)*

- ☐ Cultural, educational or hobby organization
- ☐ Labor union
- ☐ Professional association
- ☐ Immigrant or ethnic association or club
- ☐ Sports or recreation organization
- ☐ Environment, conservation, or wildlife organization
- ☐ Religious-affiliated group
- ☐ Service club
- ☐ Political party or club
- ☐ Other (specify) _____
- ☐ None

8. **What is your home zip code?** Zip Code: _____

9. **How long have you lived in your neighborhood?**

0-2 years	3-5 years	More than 5 years
☐	☐	☐

10. **What type of building do you live in?**

- ☐ Single-family
- ☐ Multi-family
- ☐ Other (specify)_____
- ☐ Don't know

11. **Is your home in a location that is prone to:** *(Check all that apply)*

- ☐ Floods
- ☐ Earthquakes
- ☐ Landslides
- ☐ Liquefaction
- ☐ Tsunamis
- ☐ None of the above
- ☐ Don't know

12. **What is your race or origin?** *(Check all that apply)*

- ☐ White
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ American Indian or Alaska Native
- ☐ Hispanic, Latino, or Spanish origin (specify) _____
- ☐ Asian (specify) _____
- ☐ Other race or origin (specify)_____

13. **What is your gender?**

- ☐ Female
- ☐ Male
- ☐ Other

14. **What is your present religion, if any?**

☐ Protestant	☐ Orthodox (Greek or Russian)
☐ Roman Catholic	☐ Jewish
☐ Mormon	☐ Muslim
☐ Buddhist	☐ Hindu
☐ Atheist	☐ Other (specify)_____
☐ Agnostic	☐ None

15. **What language(s) do you speak at home?** *(Check all that apply)*

☐ English	☐ Somali
☐ Spanish	☐ Korean
☐ Chinese	☐ Russian
☐ Vietnamese	☐ Other (specify)_____

16. **What was your total household income before taxes during the past 12 months?**

- ☐ Less than $25,000
- ☐ $25,000 to $34,999
- ☐ $35,000 to $49,999
- ☐ $50,000 to $74,999
- ☐ $75,000 to $99,999
- ☐ $100,000 to $149,999
- ☐ $150,000 to $199,999
- ☐ $200,000 or more

17. **What is your birthday?** Month: _____ Year: _____

18. This extra question will help local government better understand how to improve community preparedness. **In the first 72 hours following a disaster, please indicate how much you would expect to rely on the following for assistance.** *Please use a scale of 1 to 5, with 5 being "expect to rely on a great deal" and 1 being "do not expect to rely on at all."*

	Do not expect to rely on at all 1	2	3	4	Expect to rely on a great deal 5
Household members	☐	☐	☐	☐	☐
People in my neighborhood	☐	☐	☐	☐	☐
Non-profit organizations, such as the American Red Cross or the Salvation Army	☐	☐	☐	☐	☐
My faith community, such as a congregation	☐	☐	☐	☐	☐
Fire, police, emergency personnel	☐	☐	☐	☐	☐
State and Federal Government agencies, including FEMA	☐	☐	☐	☐	☐

Thank you for completing the survey! Please return it in the enclosed pre-addressed postage-paid envelope.

We welcome any additional thoughts you might have about preparedness, on the front cover or by email to M9survey@uw.edu.

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Appendix C: Community disaster preparedness survey in English

COMMUNITY PREPAREDNESS SURVEY

1. **Have you personally experienced an earthquake?** *(Select one)*

   ☐ Yes ☐ No [skip to question 2] ☐ Not sure [skip to question 2]

   If Yes: 1a. **Where and when did you experience this earthquake** (your most memorable earthquake)?

   Where: _____ When: _____

   1b. **How strong was the shaking that you felt?** *(Select one)*

Not felt	Weak shaking (felt, but unsure was a quake)	Mild shaking (dishes, windows, doors shook)	Moderate shaking (dishes, windows broken)	Strong shaking (heavy furniture moved)	Violent shaking (great damage)	Not applicable
☐	☐	☐	☐	☐	☐	☐

2. **Which of these preparations for a disaster do you have, or could you rely on friends, family and neighbors for?** *(Check all that apply)*

   ☐ Flashlight with batteries or solar
   ☐ Radio with batteries or solar
   ☐ First aid kit
   ☐ Emergency plan
   ☐ Secured heavy furniture to the walls
   ☐ Supply of water and non-perishable food
   ☐ None of the above

3. **Consider how you and your family, friends, and neighbors might share. About how many days' worth of food do you have available, altogether?** *(Select one)*

None	1-3 days	4-6 days	1-2 weeks	3-4 weeks	More than 4 weeks
☐	☐	☐	☐	☐	☐

4. **Consider how you and your family, friends, and neighbors might share. About how many days' worth of water do you have available, altogether?** *(Select one)*

None	1-3 days	4-6 days	1-2 weeks	3-4 weeks	More than 4 weeks
☐	☐	☐	☐	☐	☐

5. **Which of these statements resonates most with you?** *(Select one)*

   ☐ Most people would try to take advantage of you if they got the chance
   ☐ Most people would try to be fair

6. **Which of these statements resonates most with you?** *(Select one)*

   ☐ Most of the time people try to be helpful
   ☐ Most of the time people are mostly just looking out for themselves

7. **In the past 12 months, were you a member or participant in a** *(Check all that apply)*

- ☐ Cultural, educational or hobby organization
- ☐ Labor union
- ☐ Professional association
- ☐ Immigrant or ethnic association or club
- ☐ Sports or recreation organization
- ☐ Environment, conservation, or wildlife organization
- ☐ Religious-affiliated group
- ☐ Service club
- ☐ Political party or club
- ☐ Other (specify) _____
- ☐ None

8. **What is your home zip code?** Zip Code: _____

9. **How long have you lived in your neighborhood?**

0-2 years	3-5 years	More than 5 years
☐	☐	☐

10. **What type of building do you live in?**

- ☐ Single-family
- ☐ Multi-family
- ☐ Other (specify)_____
- ☐ Don't know

11. **Is your home in a location that is prone to:** *(Check all that apply)*

- ☐ Floods
- ☐ Earthquakes
- ☐ Landslides
- ☐ Liquefaction
- ☐ Tsunamis
- ☐ None of the above
- ☐ Don't know

12. **What is your race or origin?** *(Check all that apply)*

- ☐ White
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ American Indian or Alaska Native
- ☐ Hispanic, Latino, or Spanish origin (specify) _____
- ☐ Asian (specify) _____
- ☐ Other race or origin (specify)_____

13. **What is your gender?**

- ☐ Female
- ☐ Male
- ☐ Other

14. **What is your present religion, if any?**

☐ Protestant	☐ Orthodox (Greek or Russian)
☐ Roman Catholic	☐ Jewish
☐ Mormon	☐ Muslim
☐ Buddhist	☐ Hindu
☐ Atheist	☐ Other (specify)_____
☐ Agnostic	☐ None

15. **What language(s) do you speak at home?** *(Check all that apply)*

☐ English	☐ Somali
☐ Spanish	☐ Korean
☐ Chinese	☐ Russian
☐ Vietnamese	☐ Other (specify)_____

16. **What was your total household income before taxes during the past 12 months?**

- ☐ Less than $25,000
- ☐ $25,000 to $34,999
- ☐ $35,000 to $49,999
- ☐ $50,000 to $74,999
- ☐ $75,000 to $99,999
- ☐ $100,000 to $149,999
- ☐ $150,000 to $199,999
- ☐ $200,000 or more

17. **What is your birthday?** Month: _____ Year: _____

18. This extra question will help local government better understand how to improve community preparedness. **In the first 72 hours following a disaster, please indicate how much you would expect to rely on the following for assistance.** *Please use a scale of 1 to 5, with 5 being "expect to rely on a great deal" and 1 being "do not expect to rely on at all."*

	Do not expect to rely on at all 1	2	3	4	Expect to rely on a great deal 5
Household members	☐	☐	☐	☐	☐
People in my neighborhood	☐	☐	☐	☐	☐
Non-profit organizations, such as the American Red Cross or the Salvation Army	☐	☐	☐	☐	☐
My faith community, such as a congregation	☐	☐	☐	☐	☐
Fire, police, emergency personnel	☐	☐	☐	☐	☐
State and Federal Government agencies, including FEMA	☐	☐	☐	☐	☐

Thank you for completing the survey! Please return it in the enclosed pre-addressed postage-paid envelope.

We welcome any additional thoughts you might have about preparedness, on the front cover or by email to M9survey@uw.edu.

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Chapter 5: Conclusion

This dissertation includes three chapters exploring why and how communities matter in disaster preparedness. The findings illustrate how using local knowledge and social connections can enhance disaster preparedness, in Washington State and elsewhere.

The Chapter 2 case study from Plain, Washington demonstrates how an asset-based community readiness approach combined with storytelling and scenario planning can be used to devise robust and contingent planning strategies for hazard mitigation. This approach encourages communities to generate stories about the community's identity, values, and assets. The Chapter shows how this approach may help mobilize community members to actively engage with one another, and devise solutions on the multiple ways to survive and evolve while enhancing local and political support for the strategies this process generates. For example, one scenario group said, "*We galvanized to advocate and lobby our local, state, federal political representatives to address local needs. We need land management agencies to work in partnership with private landowners and the overall community to create a fire-resistant community. This means better forest management (e.g., tree thinning and prescribed burns to reduce forest fuel), local emergency management, and upgrading and enforcing building codes."* More tangibly, robust strategies common to multiple scenarios can help set investment and policy priorities, and contingent strategies can help planners anticipate differing futures. Robust planning involves developing strategies that are relevant to multiple future scenarios. Some robust strategies included more protection for the built and natural capitals. Participants expressed the need to advocate for stricter building codes and grants for retrofitting, restricting development to preserve the natural features, and protecting critical infrastructure. In addition, participants expressed the need for state and federal forest services to implement landscape treatments in the forest which include prescribed burns, fuel breaks, and thinning. All these measures are proven to reduce fire risk in the wildland urban interface and mitigate against flooding. Finally, all scenario groups struggled with how to thin the forest of ladder fuels without having a lumber mill in the area, mills had shut down when logging in the area decreased during the last 40-50 years. One scenario group came up with the idea of establishing a public-private small-diameter mill. This was a creative and innovative strategy that could also provide jobs for the local community, something they think would make the community better. Contingent planning involves creating plans for each future scenario just in case the future in the plan is realized. Each contingent plan could be considered a playbook for a particular future scenario. For example, in scenarios where population increases, planners should consider containing growth to minimize fire and flooding risks. In scenarios where population decreases, investments in fire and flooding mitigation, planners should consider finding funding for mitigation without a strong tax base. Multiple strategies and plans in place can help communities and planners alike to adapt more rapidly in uncertain and changing times.

With a survey experiment conducted across contrasting areas of Seattle (South Seattle and Other Seattle), Chapter 3 reveals how assets that are available on a day-to-day basis—specifically food, water, and social capital—can contribute to disaster preparedness. No difference in bonding social capital (connections within groups of similar characteristics, attitudes, and resources) was evident between South Seattle (ethnically diverse, low-income, less formally educated) and Other Seattle (predominantly white, middle- to high-income, more formally educated), but Other Seattle reported more bridging social capital (connections between individuals who are not like to them in respect to socioeconomic or other characteristics) than South Seattle. Bonding and bridging social capital were, as expected, both associated with increased preparedness, measured as having more preparedness items available. This means that those with greater social capital will likely be more prepared for disasters. Specifically, the findings mean that those living in Other Seattle are likely to have more social connections available for response and recovery in the event of a Cascadia subduction zone megaquake or other disaster, relative to those living in South Seattle. Accounting for shared resources also increased reported preparedness levels beyond asking for reports of resources available to individual households. These findings suggest further research on alternative disaster preparedness measurements is warranted to support improved survey methods and measures for disaster preparedness.

Finally, Chapter 4 examines reliance on household members, people in the neighborhood, and local professional responders (fire, police, and emergency personnel) to understand which response group respondents will rely on the most and why. The study investigates the roles of fairness, general reciprocity (trust), and preparations to understand how, if at all, these variables influence reliance on informal (e.g., one's household members) and formal (i.e. Fire, Police and Emergency Personnel) response groups. As anticipated, perceptions of fairness were lower in South Seattle—with its more diverse communities and historical legacy of mistreatment from those in power—than in Other Seattle, which is predominantly white and higher income. Overall, trust and some measures of preparedness were associated with increased reliance on all response groups in this study, controlling for other factors. Trust in informal and formal response groups is healthy for an effective response and recovery. Some preparedness measures, including considering shared resources (CDP), rather than individual household disaster preparedness (IDP) alone, reduced reliance on local professional responders. Reliance by race and origin varied across the three models. In the 'Household members' model, the Hispanic, Latino, or Spanish origin; Two or More Races or Origin; and Filipino categories had positive coefficients, all else equal. This suggests that these groups will rely more on their household members as compared to the white category. In the 'People in my neighborhood' model, the American Indian or Alaska Native group expects to rely less on people in one's own neighborhood than the white group while the Two or More Races or Origin groups will rely more on the people in one's own neighborhood than the white group. In the 'Fire, police, and emergency personnel' model, Asian (excluding Chinese, Filipino, Japanese, and Vietnamese), Black or African American, Two or More Races or Origin, Chinese, Filipino, and

Vietnamese groups expect to rely more on local professional responders than the white group. The mixed results in the race or origin categories across the three models suggests that more studies that focus on historical oppressions on different groups could help us understand how oppression may influence reliance and fairness across varying characteristics. Additional research on fairness that examines multilevel influences on preparedness would also be helpful.

To conclude, in this dissertation, I articulate an alternative approach to hazards practice and research that is asset-based, community focused, and relationship-driven to reduce risk in the most marginalized communities and for the safety of all. This approach, which I call asset-based community (ABC) readiness, involves accounting for daily resources available in society, the built environment, and the natural environment. These resources or assets can be measured, combined and multiplied to focus on locally identified disaster preparedness and mitigation needs. Once needs are identified internally within a community, community members can also build bridging relationships with people and institutions with different levels of power and resources to collectively address those needs. This approach can build resilience to all hazards for all, and especially for those most at risk.